

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 1/2, 1982 January/February. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 1/2

1982 JANUARY/FEBRUARY

PAPERS

Musical Sound Synthesis by Forward Differences Yasuhiro Mitsuhashi 2
A New Method of Measuring Transient Intermodulation Distortion: Comparison with the Conventional Method
 Susumu Takahashi and Susumu Tanaka 10

ENGINEERING REPORTS

Three-Dimensional Energy Plots in the Frequency Domain
 G. Bank and G. T. Hathaway 17
An Adapting Delay Comb Filter for the Restoration of Audio Signals Badly Corrupted with a Periodic Signal of Slowly Changing Frequency
 Bernard A. Hutchins, Jr., and Walter H. Ku 24
A Professional Digital Audio Mixer
 N. Sakamoto, S. Yamaguchi, and A. Kurahashi 28

PERSONAL CALCULATOR PROGRAMS

Calculator Program for Head-Related Transfer Function
 Duane H. Cooper 34

DIGITAL AUDIO TECHNICAL COMMITTEE REPORTS

Minutes of the Meeting of the Digital Audio Technical Committee (1981 November 2) Bart Locanthi 40
Report of the AES Technical Committee on Sound Reinforcement Components (1981 November 1) Clifford A. Henricksen 46

STANDARDS

Standards News 48

FEATURES

71st Convention Preview 54
Exhibitors 55
Previews 56

DEPARTMENTS

Review of Acoustical Patents 50
Sound Track 78
News of the Sections 82
Available Literature 84
Upcoming Meetings 88
Membership Information 89
In Memoriam 96

Editorial Staff

	Harry F. Olson	Editor Emeritus
	Robert O. Fehr	Editor
Patricia M. Macdonald	Managing Editor	Abbie J. Cohen Senior Editor
Ingeborg M. Stochmal	Copy Editor	Gerri M. Calamusa Production Editor/Advertising
	G. Franklin Montgomery	Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. A. Greiner	J. H. Kogen	M. R. Schroeder
B. Blesser	R. C. Heyser	B. Locanthi	D. E. L. Shorter
C. R. Cable	W. J. J. Hoge	J. F. McGill	R. H. Small
R. C. Cabot	J. M. Hollywood	J. G. McKnight	T. G. Stockham, Jr.
M. Camras	T. Holman	R. A. Moog	E. L. Torick
D. H. Cooper	P. Kantrowitz	J. A. Moorer	E. M. Villchur
J. M. Eargle	J. M. Kates	J. T. Mullin	D. R. von Recklinghausen
E. J. Foster	D. L. Klepper	D. Preis	J. V. White
M. B. Gardner	P. W. Klipsch	D. Queen	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 3, 1982 March. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 3

1982 MARCH

PAPERS

Computerized Analysis and Observation of the Vibration Modes of a Loudspeaker Cone Kiyooki Suzuki and Isami Nomoto 98
Strain-Gauge Sensors Eliminate Acoustic Feedback in Amplified Acoustic Stringed Instruments C. Ernst Nourney 107

ENGINEERING REPORTS

Measuring Loudspeaker Constants by a Transient Method Oluf Jacobsen 112
An Experimental "All Digital" Studio Mixing Desk John W. Richards and Ian Craven 117
A Flexible Digital Sound-Editing Program for Minicomputer Systems M. Griffiths and P. J. Bloom 127
A Simple Hardware Pitch Extractor Bernard A. Hutchins, Jr., and Walter H. Ku 135

STANDARDS AND RECOMMENDED PRACTICES

AES Draft Recommended Practice for Specification of Loudspeaker Components Used in Professional Audio and Sound Reinforcement 140
Standards News from *JASA* (Reprint, *JASA*, Vol. 70, pp. 232-233, 1982 January) 146

DEPARTMENTS

Review of Acoustical Patents 150
News of the Sections 156
Sound Track 160
Upcoming Meetings 163
New Products and Developments 164
Available Literature 167
Membership Information 169

Editorial Staff

Harry F. Olson Editor Emeritus
Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Ingeborg M. Stochmal Copy Editor
Abbie J. Cohen Senior Editor
Gerri M. Calamusa Production Editor/Advertising
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. A. Greiner	J. H. Kogen	M. R. Schroeder
B. Blesser	R. C. Heyser	B. Locanthi	D. E. L. Shorter
C. R. Cable	W. J. J. Hoge	J. F. McGill	R. H. Small
R. C. Cabot	J. M. Hollywood	J. G. McKnight	T. G. Stockham, Jr.
M. Camras	T. Holman	R. A. Moog	E. L. Torick
D. H. Cooper	P. Kantrowitz	J. A. Moorer	E. M. Villchur
J. M. Eargle	J. M. Kates	J. T. Mullin	D. R. von Recklinghausen
E. J. Foster	D. L. Klepper	D. Preis	J. V. White
M. B. Gardner	P. W. Klipsch	D. Queen	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 4, 1982 April.
Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 4

1982 APRIL

PAPERS

Output Resistance and Intermodulation Distortion of Feedback Amplifiers Edward M. Cherry and Gregory K. Cambrell 178
Piecewise Interpolation Technique for Audio Signal Synthesis Yasuhiro Mitsuhashi 192

ENGINEERING REPORTS

Improvement of Multichannel Radio Microphone Operation by Use of Advanced Receiver Techniques E. Werner 203
The Autobias Amplifier: A New Topology for Automatically Biased Audio Amplifiers Using Power MOSFETs Bill Roehr 208
On Disk-Record Echo Phenomena Otfried Stephani 217

LETTERS TO THE EDITOR

Comments on "Absorption of Sound Air: A Personal Calculator Program" Knud Wendelboe 225
Author's Reply Benjamin Bernfeld 225

STANDARDS

The S4 Committee on Audio Engineering and Its Relation to Other National and International Standards Activity Geoffrey M. Langdon 227
Status of Current Standards in Audio and Acoustics Daniel Queen 231
A History of Audio Standards Writing in the USA John G. McKnight 240
Role of the AES Technical Council in Standards Writing Richard H. Campbell 248

FEATURES

Premier AES Conference: The New World of Digital Audio 252

TECHNICAL COMMITTEE REPORTS

Digital Working Group Activity 254
Corrections to Report of Digital Audio Technical Committee Meeting (1981 November 2) 254

DEPARTMENTS

Upcoming Meetings 251
News of the Sections 255
Sound Track 258
New Products and Developments 260
Available Literature 262
Membership Information 264
In Memoriam 275
Call for Papers—72nd Convention, Anaheim, California, 1982 276
Communicating Through Poster Sessions Mahlon D. Burkhard 278
Information for Authors of Convention Preprints 280

Editorial Staff

	Harry F. Olson Editor Emeritus	
	Robert O. Fehr Editor	
Patricia M. Macdonald Managing Editor		Abbie J. Cohen Senior Editor
Ingeborg M. Stochmal Copy Editor		Geri M. Calamusa Production Editor/Advertising
	G. Franklin Montgomery Consulting Technical Editor	

Review Board

L. A. Abbagnaro	R. A. Greiner	J. H. Kogen	M. R. Schroeder
B. Blesser	R. C. Heyser	B. Locanthi	D. E. L. Shorter
C. R. Cable	W. J. J. Hoge	J. F. McGill	R. H. Small
R. C. Cabot	J. M. Hollywood	J. G. McKnight	T. G. Stockham, Jr.
M. Camras	T. Holman	R. A. Moog	E. L. Torick
D. H. Cooper	P. Kantrowitz	J. A. Moorer	E. M. Villchur
J. M. Eargle	J. M. Kates	J. T. Mullin	D. R. von Recklinghausen
E. J. Foster	D. L. Klepper	D. Preis	J. V. White
M. B. Gardner	P. W. Klipsch	D. Queen	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 5, 1982 May. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 5

1982 MAY

PAPERS

Feedback, Sensitivity, and Stability of Audio Power Amplifiers Edward M. Cherry 282

Nested Differentiating Feedback Loops in Simple Audio Amplifiers Edward M. Cherry 295

Alignment of Filter-Assisted Vented-Box Loudspeaker Systems with Enclosure Losses R. A. R. Bywater and H. J. Wiebell 306

ENGINEERING REPORTS

Extension of the Dynamic Range of Wireless Microphones Wilfried Pohl and Erhard Werner 318

Feedforward Floating Power Supply (High-Response-Speed Equalizer Circuit) Eiichi Funasaka and Hikaru Kondou 324

High-Resolution Subjective Testing Using a Double-Blind Comparator David Clark 330

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 71, pp. 767-772, 1982 March) 339

Standards News 344

TECHNICAL COMMITTEE REPORTS

AES Digital Audio Technical Committee Resolution of 1981 November 2 Emil Torick 344

FEATURES

71st Convention Report 346

Exhibitors 352

Program 354

DEPARTMENTS

News of the Sections 363

Sound Track 365

Upcoming Meetings 366

New Products and Developments 367

Available Literature 370

Abstracts of Interest 372

Membership Information 373

In Memoriam 380

Membership Form 382

Editorial Staff

	Robert O. Fehr Editor	
Patricia M. Macdonald Managing Editor		Abbie J. Cohen Senior Editor
Ingeborg M. Stochmal Copy Editor		Geri M. Calamusa Production Editor/Advertising
	G. Franklin Montgomery Consulting Technical Editor	

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	M. R. Schroeder
B. Blesser	W. J. J. Hoge	B. Locanthi	D. E. L. Shorter
C. R. Cable	J. M. Hollywood	J. F. McGill	R. H. Small
R. C. Cabot	T. Holman	J. G. McKnight	T. G. Stockham, Jr.
M. Camras	P. Kantrowitz	R. A. Moog	E. L. Torick
D. H. Cooper	J. M. Kates	J. A. Moorer	E. M. Villchur
J. M. Eargle	D. L. Klepper	J. T. Mullin	D. R. von Recklinghausen
M. B. Gardner	P. W. Klipsch	D. Preis	J. V. White
R. A. Greiner	J. H. Kogen	D. Queen	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 6, 1982 June.
Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA. Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 6

1982 JUNE

PAPERS

Cumulative Spectra, Tone Bursts, and Apodization John D. Bunton and Richard H. Small 386
Synthesis by Spectral Amplitude and "Brightness" Matching of Analyzed Musical Instrument Tones James W. Beauchamp 396
Central Cluster Design Technique for Large Multipurpose Auditoria E. T. Patronis, Jr., and Catharina Donders 407
Loudspeaker Coverage by Architectural Mapping Ted Uzzle 412
A Polar-Plot Method of Loudspeaker Array Design Farrel M. Becker 425

ENGINEERING REPORTS

Listening Tests—Turning Opinion into Fact Floyd E. Toole 431

LETTERS TO THE EDITOR

Comments on "A New Criterion for the Distribution of Normal Room Modes" James B. Lee 446
Author's Reply Oscar J. Bonello 446

DIGITAL AUDIO TECHNICAL COMMITTEE REPORTS

Minutes of the Meeting of the Digital Audio Technical Committee (1982 March 3) Bart Locanthi 448

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 71, pp. 1300-1302, 1982 May) 454

FEATURES

Midwest Acoustics Conference (MAC 82) 460

DEPARTMENTS

Upcoming Meetings 464
News of the Sections 464
Sound Track 467
New Products and Developments 470
Available Literature 472
Membership Information 473

Editorial Staff

	Robert O. Fehr Editor	
Patricia M. Macdonald Managing Editor		Abbie J. Cohen Senior Editor
Ingeborg M. Stochmal Copy Editor		Gerri M. Calamusa Production Editor/Advertising
	G. Franklin Montgomery Consulting Technical Editor	

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	M. R. Schroeder
B. Blesser	W. J. J. Hoge	B. Locanthi	D. E. L. Shorter
C. R. Cable	J. M. Hollywood	J. F. McGill	R. H. Small
R. C. Cabot	T. Holman	J. G. McKnight	T. G. Stockham, Jr.
M. Camras	P. Kantrowitz	R. A. Moog	E. L. Torick
D. H. Cooper	J. M. Kates	J. A. Moorer	E. M. Villchur
J. M. Eargle	D. L. Klepper	J. T. Mullin	D. R. von Recklinghausen
M. B. Gardner	P. W. Klipsch	D. Preis	J. V. White
R. A. Greiner	J. H. Kogen	D. Queen	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 7/8, 1982 July/August. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 7/8

1982 JULY/AUGUST

PAPERS

Loudspeaker-Crossover Systems: An Optimal Crossover Choice Robert M. Bullock, III 486

Computer-Aided Design of Loudspeaker Crossover Networks G. J. Adams and S. P. Roe 496

Dynamic-Range Requirement for Subjectively Noise-Free Reproduction of Music Louis D. Fielder 504

Notes on the Development of a New Type of Hornless Loudspeaker (Reprint) Chester W. Rice and Edward W. Kellogg 512

ENGINEERING REPORTS

Tone-Burst Testing on Selected Electronic Crossover Networks R. A. Greiner 522

Anechoic Chamber with Optional Boundaries James R. Hunter and Paul W. Klipsch 528

FEATURES

Premier Conference: The New World of Digital Audio Report 536

Program 540

DEPARTMENTS

Review of Acoustical Patents 532

News of the Sections 550

Upcoming Meetings 554

Sound Track 554

New Products and Developments 555

Available Literature 557

Membership Information 559

In Memoriam 567

AES Annual Report 568

Call for Papers—73rd Convention, Eindhoven, Netherlands, 1983 569

Information for Authors of Convention Papers 572

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Ingeborg M. Stochmal Copy Editor
G. Franklin Montgomery Consulting Technical Editor
Abbie J. Cohen Senior Editor
Gerri M. Calamusa Production Editor/Advertising

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	M. R. Schroeder
B. Blesser	W. J. J. Hoge	B. Locanthi	D. E. L. Shorter
C. R. Cable	J. M. Hollywood	J. F. McGill	R. H. Small
R. C. Cabot	T. Holman	J. G. McKnight	T. G. Stockham, Jr.
M. Camras	P. Kantrowitz	R. A. Moog	E. L. Torick
D. H. Cooper	J. M. Kates	J. A. Moorer	E. M. Villchur
J. M. Eargle	D. L. Klepper	J. T. Mullin	D. R. von Recklinghausen
M. B. Gardner	P. W. Klipsch	D. Preis	J. V. White
R. A. Greiner	J. H. Kogen	D. Queen	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 9, 1982 September. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 9

1982 SEPTEMBER

PAPERS

Tonearm Geometry and Frequency-Modulation Distortion
..... Raymond Kilmanas 574
Discussion: J. Rabinow 579
..... Raymond Kilmanas 579
On the Audibility of Midrange Phase Distortion in Audio Systems
..... Stanley P. Lipshitz, Mark Pocock, and John Vanderkooy 580
A New Magnetic Tape Recorder with Automatic Adjusting Functions for Bias and Recording Conditions
..... N. Sakamoto, T. Kogure, M. Ogino, and H. Kitagawa 596

ENGINEERING REPORTS

An Amplifier for Electret Headphones M. Kröning, R. Lerch, and R. Zahn 607
Optically Encoded Moving Shutter Attenuator G. James Keller 610
The Design and Testing of a "New" Reverberation Meter
..... C. E. Livingstone, T. E. Base, and A. F. Hawtin 614

LETTERS TO THE EDITOR

Comments on "Examination of Audio-Bandwidth Requirements for Optimum Sound Signal Transmission" Thomas E. Miller 621

CORRECTIONS

Correction to "Synthesis by Spectral Amplitude and 'Brightness' Matching of Analyzed Musical Instrument Tones" 621
Correction to "Alignment of Filter-Assisted Vented-Box Loudspeaker Systems with Enclosure Losses" 621

TECHNICAL COMMITTEE REPORTS

Report of the Meeting of the Digital Audio Technical Committee Working Group on Sampling Frequencies (1982 June 3) Emil L. Torick 621

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 72, pp. 294-297, 1982 July) 622

FEATURES

72nd Convention Preview 632
Exhibitors 633
Previews 634

DEPARTMENTS

News of the Sections 670
Sound Track 676
Available Literature 678
Upcoming Meetings 680
Abstracts of Interest 681
Membership Information 682
In Memoriam 691

Editorial Staff

	Robert O. Fehr Editor	
Patricia M. Macdonald Managing Editor	Abbie J. Cohen Senior Editor	
Ingeborg M. Stochmal Copy Editor	Gerri M. Calamusa Production Editor/Advertising	
G. Franklin Montgomery	Consulting Technical Editor	

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	D. E. L. Shorter
R. C. Cabot	T. Holman	J. F. McGill	R. H. Small
M. Camras	P. Kantowitz	J. G. McKnight	E. L. Torick
D. H. Cooper	J. M. Kates	R. A. Moog	J. Vanderkooy
J. M. Eargle	D. L. Klepper	J. A. Moorer	D. R. von Recklinghausen
M. B. Gardner	P. W. Klipsch	J. T. Mullin	J. V. White
R. A. Greiner	J. H. Kogen	D. Preis	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 10, 1982 October. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 10

1982 OCTOBER

PAPERS

On the Magnitude and Audibility of FM Distortion in Loudspeakers Roy Allison and Edgar Villchur 694

Audio Signal Synthesis by Functions of Two Variables Yasuhiro Mitsuhashi 701

M-S Stereo: A Powerful Technique for Working in Stereo Wesley L. Dooley and Ronald D. Streicher 707

Controlling Sound-Image Localization in Stereophonic Reproduction: II Naraji Sakamoto, Toshiyuki Gotoh, Takuyo Kogure, Masatoshi Shimbo, and Almon H. Clegg 719

ENGINEERING REPORTS

Ground-Plane Acoustic Measurement of Loudspeaker Systems Mark R. Gander 723

A Touch-Sensitive Keyboard for Electronic Music Gerald M. Shapiro and Bill Cullen 732

TECHNICAL COMMITTEE REPORTS

Report of the Meeting of the Working Group on Input/Output Interfacing (1982 June 3) Alastair Heaslett 736

FEATURES

Review of Society's Sustaining Members 738

DEPARTMENTS

Upcoming Meetings 752

News of the Sections 754

Sound Track 757

Available Literature 760

New Products and Developments 762

Membership Information 765

In Memoriam 772

Editorial Staff

	Robert O. Fehr Editor	
Patricia M. Macdonald Managing Editor	Abbie J. Cohen Senior Editor	
Ingeborg M. Stochmal Copy Editor	Gerri M. Calamusa Production Editor/Advertising	
G. Franklin Montgomery Consulting Technical Editor		

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	D. E. L. Shorter
R. C. Cabot	T. Holman	J. F. McGill	R. H. Small
M. Camras	P. Kantrowitz	J. G. McKnight	E. L. Torick
D. H. Cooper	J. M. Kates	R. A. Moog	J. Vanderkooy
J. M. Eargle	D. L. Klepper	J. A. Moorer	D. R. von Recklinghausen
M. B. Gardner	P. W. Klipsch	J. T. Mullin	J. V. White
R. A. Greiner	J. H. Kogen	D. Preis	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 11, 1982 November. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 11

1982 NOVEMBER

PAPERS

Phase Distortion and Phase Equalization in Audio Signal Processing—A Tutorial Review D. Preis 774
Low-Distortion Programmable Gain Cell Using Current-Steering Cascode Topology Malcolm John Hawksford 795
Direct Low-Frequency Driver Synthesis from System Specifications D. B. Keele, Jr. 800
The LaVerne Terrace Low-Pass Filter Lee Powell 815

ENGINEERING REPORTS

Restoration of Nonlinearly Distorted Audio by Histogram Equalization Stanley A. White 828

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 72, pp. 1083–1088, 1982 September) 834

FEATURES

1983 AES Sections Directory 844

DEPARTMENTS

News of the Sections 852
Sound Track 854
Upcoming Meetings 854
New Products and Developments 855
Available Literature 858
Abstracts of Interest 860
Membership Information 861

Editorial Staff

	Robert O. Fehr Editor	
Patricia M. Macdonald Managing Editor	Abbie J. Cohen Senior Editor	
Ingeborg M. Stochmal Copy Editor	Gerri M. Calamusa Production Editor/Advertising	
	G. Franklin Montgomery Consulting Technical Editor	

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	D. E. L. Shorter
R. C. Cabot	T. Holman	J. F. McGill	R. H. Small
M. Camras	P. Kantrowitz	J. G. McKnight	E. L. Torick
D. H. Cooper	J. M. Kates	R. A. Moog	J. Vanderkooy
J. M. Eargle	D. L. Klepper	J. A. Moorer	D. R. von Recklinghausen
M. B. Gardner	P. W. Klipsch	J. T. Mullin	J. V. White
R. A. Greiner	J. H. Kogen	D. Preis	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 30, Number 12, 1982 December. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1982 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

A copying fee for post-1980 articles is included in the code at the bottom of the first page of each article. This fee should be paid to the Audio Engineering Society through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970, USA.

The same copying fee applies to pre-1981 articles.

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 30 NUMBER 12

1982 DECEMBER

President's Message Thomas G. Stockham, Jr. 870

PAPERS

The Design of Distributed Sound Systems from Uniformity of Coverage and Other Sound-Field Considerations Rex Sinclair 871

Low-Frequency Measurement of Loudspeakers by the Reciprocity Method Josef Merhaut 882

A Multitrack Digital Audio Recorder for Consumer Applications W. J. van Gestel, L. M. H. E. Driessen, and J. C. F. Moeskops 889

Acoustic Radiation of a Horn Loudspeaker by the Finite Element Method—Acoustic Characteristics of a Horn Loudspeaker with an Elastic Diaphragm Noboru Kyouno, Shinichi Sakai, Shigeru Morita, Tatsuo Yamabuchi, and Yukio Kagawa 896

ENGINEERING REPORTS

Transient-Response Equalization of Sealed-Box Loudspeakers Victor Staggs 906

LETTERS TO THE EDITOR

Comments on "Determination of Sliding Friction Between Stylus and Record Groove" D. A. Barlow 912

Author's Reply R. P. Pardee 913

TECHNICAL COMMITTEE REPORTS

A Review of Issues Related to the Choice of Sample Rates for Digital Audio J. J. Gibson 914

Appendix J. J. Gibson and L. Schiff 920

FEATURES

72nd Convention Report 926

Exhibitors 936

Program 940

New AES Officers 1982/83 958

DEPARTMENTS

Upcoming Meetings 960

News of the Sections 961

Sound Track 964

New Products and Developments 965

Available Literature 967

Abstracts of Interest 968

Membership Information 969

Index to Volume 30 973

Editorial Staff

	Robert O. Fehr Editor	
Patricia M. Macdonald Managing Editor	Abbie J. Cohen Senior Editor	
Ingeborg M. Stochmal Copy Editor	Gerri M. Calamusa Production Editor/Advertising	
G. Franklin Montgomery Consulting Technical Editor		

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	D. E. L. Shorter
R. C. Cabot	T. Holman	J. F. McGill	R. H. Small
M. Camras	P. Kantrowitz	J. G. McKnight	E. L. Torick
D. H. Cooper	J. M. Kates	R. A. Moog	J. Vanderkooy
J. M. Eargle	D. L. Klepper	J. A. Moorer	D. R. von Recklinghausen
M. B. Gardner	P. W. Klipsch	J. T. Mullin	J. V. White
R. A. Greiner	J. H. Kogen	D. Preis	J. G. Woodward

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 1/2, 1983 January/February. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, Editorial Office, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 31 NUMBER 1/2

1983 JANUARY/FEBRUARY

PAPERS

A Family of Linear-Phase Crossover Networks of High Slope Derived by Time Delay Stanley P. Lipshitz and John Vanderkooy 2

ENGINEERING REPORTS

Phase Error in Tape Cartridges for Radio Broadcast Service A. H. Moris and J. T. Mullin 21

Graphic Equalizer with Microprocessor Susumu Takahashi, Hiromi Kameda, Yuzuru Tanaka, Harumitsu Miyazaki, Tadaaki Chikashige, and Masanobu Furukawa 25

Transformations of the Energy Sphere Martin E. G. Willcocks 29

TECHNICAL COMMITTEE REPORTS

Report of the Meeting of the Digital Audio Technical Committee (1982 October 22) Bart N. Locanthi 37

Report of the Meeting of the Working Group on Input/Output Interfacing (1982 October 21) Alastair Heaslett 39

Report of the Meeting of the Working Group on Digital Measurement Techniques (1982 October 21) Roger Lagadec 40

Report of the Meeting of the Technical Committee on Sound-Reinforcement Components (1982 October 27) Clifford A. Henricksen 40

Report of the Meeting of the Working Group on Plane-Wave Tube Design and Practice (1982 October 25) Clifford A. Henricksen 41

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 72, pp. 1652-1656, 1982 November) 42

FEATURES

73rd Convention Preview 50

Exhibitors 51

Previews 52

DEPARTMENTS

News of the Sections 82

Sound Track 86

Available Literature 88

Abstracts of Interest 90

Upcoming Meetings 90

Membership Information 91

In Memoriam 95

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Ingeborg M. Stochmal Copy Editor
G. Franklin Montgomery Consulting Technical Editor
Abbie J. Cohen Senior Editor
Gerri M. Calamusa Production Editor/Advertising

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schuelein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorer	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 3, 1983 March.
 Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
 AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 31 NUMBER 3

1983 MARCH

PAPERS

A 20 dB Audio Noise Reduction System for Consumer Applications Ray Dolby 98
Phase Intermodulation Distortion Instrumentation and Measurements Robert R. Cordell 114

ENGINEERING REPORTS

Electronic Equalization of Closed-Box Loudspeakers R. A. Greiner and Michael Schoessow 125
Mathematical Analysis of a Pulse-Width-Modulation Digital-to-Analog Converter Yasuhiro Mitsuhashi 135
A Versatile Delay Unit with CCDs Johan A. M. Catrysse 139
Anomalies in the Frequency-Length Functions in Violin Strings Norman C. Pickering 145

LETTERS TO THE EDITOR

Comments on "A New Criterion for the Distribution of Normal Room Modes" Oscar J. Bonello and José Maria Cuchian 151

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 73, pp. 385-388, 1983 January) 152

DEPARTMENTS

Review of Acoustical Patents 158
News of the Sections 164
SoundTrack 170
New Products and Developments 173
Available Literature 177
Abstracts of Interest 180
Upcoming Meetings 180
Membership Information 181
In Memoriam 189
Audio Engineering Society Bylaws 190
Membership Form 194

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor
Ingeborg M. Stochmal Copy Editor **Gerri M. Calamusa** Production Editor/Advertising
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schulein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorer	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 4, 1983 April.
Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

**JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS**

VOLUME 31 NUMBER 4

1983 APRIL

PAPERS

Time-Frequency Distributions of Loudspeakers: The Application of the Wigner Distribution Cornelis P. Janse and Arie J. M. Kaizer 198
Channel Codings for Digital Audio Recordings Toshi T. Doi 224

ENGINEERING REPORTS

The Loudspeaker and Control Room as a Wholly Integrated System Milton T. Putnam 239
A New Method of Reducing Direct-Drive Motor Vibration in Turntables Yasuhiro Fujimoto, Masao Suzuki, Kazuyuki Fujio, Katsumi Sasamoto, and Yuji Satoh 246

COMMUNICATIONS

Hybrid RIAA Equalization Circuit Stephan J. G. Gift 253

LETTERS TO THE EDITOR

Request for Information Reynold Weidenaar 256
Correction to "The Design of Distributed Sound Systems for Uniformity of Coverage and Other Sound-Field Considerations" Rex Sinclair 256

FEATURES

Electrical Reproduction of Acoustically Recorded Cylinders and Disks Tom Owen 266

DEPARTMENTS

Review of Acoustical Patents 257
News of the Sections 276
SoundTrack 279
Upcoming Meetings 282
New Products and Developments 283
Available Literature 285
Membership Information 287
Call for Papers—74th Convention, New York City, 1983 292
Communicating Through Poster Sessions Mahlon D. Burkhard 294
Information for Authors of Convention Papers 296

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor
Ingeborg M. Stochmal Copy Editor **Gerri M. Calamusa** Production Editor/Advertising
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schulein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorer	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 5, 1983 May.
 Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
 AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 31 NUMBER 5

1983 MAY

PAPERS

Amplitude and Phase of Intermodulation Distortion... Edward M. Cherry 298
Off-Axis Performance of Multiple Loudspeakers Rex Sinclair and Ted Uzzle 305

ENGINEERING REPORTS

A New Technique for Minimizing Distortion Douglas R. Frey 320
Direct AM Stereo Detection by a PLL Synthesized Synchronous Carrier Generator Susumu Takahashi and Hiroshi Iida 326
The Twin-Tone Distortion Meter: A New Approach Han Roering 332

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 73, pp. 1082-1085, 1983 March) 341

FEATURES

73rd Convention Report 346
Exhibitors 356
Program 360

DEPARTMENTS

Upcoming Meetings 358
News of the Sections 371
Sound Track 376
New Products and Developments 378
Available Literature 383
Membership Information 385
Membership Form 390

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor
Ingeborg M. Stochmal Copy Editor **Gerri M. Calamusa** Production Editor/Advertising
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schulein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorer	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 6, 1983 June.
 Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

**JOURNAL OF THE
 AUDIO ENGINEERING SOCIETY
 AUDIO / ACOUSTICS / APPLICATIONS**

VOLUME 31 NUMBER 6

1983 JUNE

PAPERS

Design Aspects of Graphic Equalizers R. A. Greiner and Michael Schoessow 394
Improvements in Monitor Loudspeaker Systems David Smith, D. B. Keele, Jr., and John Eargle 408

ENGINEERING REPORTS

Power and Real Signals in an Audio System Georgi Penkov 423
A High-Efficiency Audio Power Amplifier Harushige Nakagaki, Nobutaka Amada, and Shigeki Inoue 430
Acoustic Scaling in the Design of Sound Control Rooms Juhani Borenien and Urpo Pakarinen 437

COMMUNICATIONS

Measurement of Nonlinear Distortion in a Band-Limited System (Reprint) A. N. Thiele 443

LETTERS TO THE EDITOR

Comments on "Musical Sound Synthesis by Forward Differences" Roberto Cerruti and Giorgio Rodeghiero 446
Author's Reply Yasuhiro Mitsuhashi 446
Comments on "On the Audibility of Midrange Phase Distortion in Audio Systems" Daniel Shanefield 447
Authors' Reply S. P. Lipshitz, M. Pocock, and J. Vanderkooy 447
Graphic Method of Investigation of the Surround and Voice-Coil Influence on Vibration of Loudspeaker Cones Andrzej Dobrucki 448

CORRECTION

Correction to "Electrical Reproduction of Acoustically Recorded Cylinders and Disks" Tom Owen 450

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 73, pp. 1877-1879, 1983 May) 451

FEATURES

Midwest Acoustics Conference (MAC 83) 455

DEPARTMENTS

News of the Sections 458
Upcoming Meetings 462
Sound Track 464
New Products and Developments 466
Available Literature 469
Membership Information 471
In Memoriam 476

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor
Ingeborg M. Stochmal Copy Editor **Gerri M. Calamusa** Production Editor/Advertising
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schulein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorer	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 7/8, 1983 July/August. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00+.50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE AUDIO ENGINEERING SOCIETY

AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 31 NUMBER 7/8

1983 JULY/AUGUST

PAPERS

- An Efficient Algorithm for Measuring the Impulse Response Using Pseudorandom Noise** Jeffrey Borish and James B. Angell 478
- Satisfying Loudspeaker Crossover Constraints with Conventional Networks—Old and New Designs**..... Robert M. Bullock, III 489
- Delta Stereophony—A Sound System with True Direction and Distance Perception for Large Multipurpose Halls**..... Gerhard Steinke 500

ENGINEERING REPORTS

- Dynamic Distortion Measurements of Tape Recorders and Electroacoustic Transducers** P. Skritek 512
- A New Approach to High-Speed Digital Signal Processing Based on Microprogramming** K. Sekiguchi, K. Ishizaka, T. K. Matsudaira, and N. Nakajima 517
- LSIs For Digital Signal Processing Based on a PCM Standard Format** Yutaka Hirota, Takanori Seno, Takashi Eguchi, Nobuyasu Takeguchi, Kazuo Nomura, Keiichi Kameda, Shigeru Hagihara, and Hiromu Niwa 523

TECHNICAL COMMITTEE REPORTS

- Report of the Meeting of the Digital Audio Technical Committee (1983 March 13)** Bart Locanthi 538

FEATURES

- 74th Convention Preview**..... 544
- Exhibitors** 545
- Previews** 546

DEPARTMENTS

- News of the Sections** 584
- Upcoming Meetings** 588
- Sound Track** 589
- Available Literature** 591
- Abstracts of Interest** 593
- Membership Information** 594
- AES Annual Report** 602
- Call for Papers—75th Convention, Paris, 1984** 603

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor

Ingeborg M. Stochmal Copy Editor **Gerri M. Calamusa** Production Editor

Michael J. Ricca Production Editor

G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blessner	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schulein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorer	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 9, 1983 September. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 31 NUMBER 9

1983 SEPTEMBER

INTRODUCTION

Auditory Illusions and Audio..... Diana Deutsch 606

PAPERS

Auditory Illusions, Handedness, and the Spatial Environment
..... Diana Deutsch 607

Auditory Illusions and Their Relation to Mechanisms Normally Enhancing Accuracy of Perception Richard M. Warren 623

Pitch Segregation by Interaural Phase, by Momentary Amplitude Disparity, and by Monaural Phase Michael Kubovy and Jane E. Daniel 630

Demonstrations of Circular Components of Pitch Roger N. Shepard 641

Influence of Posture on the Spatial Localization of Sound
..... James R. Lackner 650

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 74(1), pp. 374-378, 1983 July)..... 662

FEATURES

Electrical Reproduction of Acoustically Recorded Cylinders and Disks, Part 2..... John C. Fesler 674

DEPARTMENTS

Review of Acoustical Patents..... 668

Sound Track..... 695

News of the Sections..... 697

New Products and Developments..... 700

Upcoming Meetings..... 702

Available Literature..... 703

Abstracts of Interest..... 705

Membership Information..... 706

Membership Application Form..... 710

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor

Ingeborg M. Stochmal Copy Editor **Michael J. Ricca** Production Editor

G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schulein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Mooror	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 10, 1983 October. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 31 NUMBER 10

1983 OCTOBER

PAPERS

Tone-Arm Outrigger Damping Devices James M. Kates 714
Glass-Fiber and Graphite-Flake Reinforced Polyimide Composite Diaphragm for Loudspeakers Susumu Takahashi, Tomomi Katoh, Sadao Taguchi, and Toshio Watanabe 723
Recording with Feedback-Controlled Effective Bias Jørgen Selmer Jensen 729
Acoustical and Electrical Interaction in Multidriver Arrays R. A. Greiner and Mark Allie 737
Fuzzy Distortion in Analog Amplifiers: A Limit to Information Transmission? M. J. Hawksford 745

ENGINEERING REPORTS

Computer-Based Signal Processing for Audio Electronic Performance Measurements Robert A. Finger 755

LETTERS TO THE EDITOR

Phase Reference in HRTF Calculation Duane H. Cooper 760

FEATURES

Review of Society's Sustaining Members 768

DEPARTMENTS

Review of Acoustical Patents 761
News of the Sections 789
Sound Track 791
Upcoming Meetings 792
New Products and Developments 794
Available Literature 798
Abstracts of Interest 800
Membership Information 801
In Memoriam 805
Membership Application Form 806

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Ingeborg M. Stochmal Copy Editor
Abbie J. Cohen Senior Editor
Michael J. Ricca Production Editor
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schuelein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorar	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 11, 1983 November. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

**JOURNAL OF THE
AUDIO ENGINEERING SOCIETY**
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 31 NUMBER 11

1983 NOVEMBER

PAPERS

A New Radio Broadcast Cartridge Capable of Professional Open-Reel Performance A. H. Morris 810
Electrical Analogs for Membranes with Application to Earphones C. A. Poldy 817
The Manifold Joys of Conformal Mapping: Applications to Digital Filtering in the Studio James A. Moorer 826

ENGINEERING REPORTS

Design Parameters Important for Optimization of Very High-Fidelity PWM (Class D) Audio Amplifiers Brian E. Attwood 842

COMMUNICATIONS

Further Thoughts on "Feedback, Sensitivity, and Stability of Audio Power Amplifiers" Edward M. Cherry 854
Distortion in Class AB Power Amplifiers Terje Sandström 858

LETTERS TO THE EDITOR

Comments on "Electronic Equalization of Closed-Box Loudspeakers" Carsten Gross 862
Comments on "Graphic Method of Investigation of the Surround and Voice-Coil Influence on Vibration of Loudspeaker Cones" Hideo Suzuki 863

FEATURES

Restoration of Kinetophone Sound Motion Pictures Arthur Shifrin 874

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 74(3), pp. 1086-1091, 1983 September) 864

DEPARTMENTS

Review of Acoustical Patents 870
Sound Track 891
News of the Sections 894
New Products and Developments 898
Upcoming Meetings 900
Available Literature 901
Membership Information 902

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor
Ingeborg M. Stochmal Copy Editor **Michael J. Ricca** Production Editor
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthe	R. B. Schulein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorer	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 31, Number 12, 1983 December.
Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1983 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use.

Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/83 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 31 NUMBER 12

1983 DECEMBER

President's Message Raymond E. Cooke 906

PAPERS

Amplitude and Phase Measurements of Vibrations of Radiating Surfaces in Order to Determine the Emitted Sound Field A. M. Bruneau 907
Some Factors Affecting the Performance of Airline Entertainment Headsets Samuel Gilman 914
A New Tape Transport System with Digital Control Oscar Juan Bonello 921

ENGINEERING REPORTS

Optimum Loudspeaker Placement Near Reflecting Planes K. O. Ballagh 931

COMMUNICATIONS

A Note on "An Amplifier Input Stage Design Criterion for the Suppression of Dynamic Distortion" Stephan J. G. Gift 936
Author's Comments W. Marshall Leach, Jr. 936

LETTERS TO THE EDITOR

More Comments on "On the Audibility of Midrange Phase Distortion in Audio Systems" James Moir 939
Comments on "Channel Codings for Digital Audio Recordings" Kees A. Schouhamer Immink 939
Author's Reply Toshi T. Doi 940

FEATURES

74th Convention Report 946
Exhibitors 954
Program 956
Theater Quality Evaluation Program Kenneth M. Mason and John P. Pytlak 976
Newly Elected AES Officers 1983/84 981
1984 AES Sections Directory 985

DEPARTMENTS

Review of Acoustical Patents 941
Upcoming Meetings 990
News of the Sections 991
Sound Track 994
New Products and Developments 995
Available Literature 997
Membership Information 998
In Memoriam 1000
Index to Volume 31 1001

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Ingeborg M. Stochmal Copy Editor
Abbie J. Cohen Senior Editor
Michael J. Ricca Production Editor
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	W. M. Leach, Jr.	D. Queen
B. Blesser	W. J. J. Hoge	S. P. Lipshitz	M. R. Schroeder
C. R. Cable	J. M. Hollywood	B. Locanthi	R. B. Schulein
R. C. Cabot	T. Holman	J. F. McGill	D. E. L. Shorter
M. Camras	P. Kantrowitz	J. G. McKnight	R. H. Small
D. H. Cooper	J. M. Kates	R. A. Moog	E. L. Torick
J. M. Eargle	D. L. Klepper	J. A. Moorser	J. Vanderkooy
M. B. Gardner	P. W. Klipsch	J. T. Mullin	D. R. von Recklinghausen
R. A. Greiner	J. H. Kogen	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 1/2, 1984 January/February. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 1/2

1984 JANUARY/FEBRUARY

PAPERS

A MOSFET Power Amplifier with Error Correction ... Robert R. Cordell 2
Extended Low-Frequency Performance of Existing Loudspeaker Systems R. Normandin 18

ENGINEERING REPORTS

Determining the Acoustic Position for Proper Phase Response of Transducers Richard C. Heyser 23
Restoration of Nonlinearly Distorted Magnetic Recordings D. Preis and H. Polchlopek 26
Optimization of the Amplified-Diode Bias Circuit for Audio Amplifiers M. J. Hawksford 31

TECHNICAL COMMITTEE REPORTS

Report of the Meeting of the Technical Committee on Sound-Reinforcement Components (1983 October 11) Clifford A. Henriksen 34
Report of the Meeting of the Digital Audio Technical Committee (1983 October 7) Bart Locanthi 34

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 74(5), pp. 1654-1658, 1983 November) 38

FEATURES

75th Convention Preview 52
Exhibitors 53
Previews 54

DEPARTMENTS

Review of Acoustical Patents 43
Second International Conference: The Art and Technology of Recording 82
News of the Sections 84
Sound Track 86
Upcoming Meetings 88
Available Literature 90
Abstracts of Interest 91
Membership Information 93
In Memoriam 98
Call for Papers—Australian Regional Convention 99
Information for Authors of Convention Papers 101
Membership Application Form 102

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor Abbie J. Cohen Senior Editor
Ingeborg M. Stochmal Copy Editor Michael J. Ricca Production Editor
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 3, 1984 March.
 Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
 AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 3

1984 MARCH

PAPERS

Resolution Below the Least Significant Bit in Digital Systems with Dither John Vanderkooy and Stanley P. Lipshitz 106
Random-Access Editing of Digital Audio Robert B. Ingebretsen and Thomas G. Stockham, Jr. 114
A Hi-Fi Moving-Magnet Cartridge Using Recent Technology Shuichi Obata, Masashi Itoh, and Koichi Azuma 123

ENGINEERING REPORTS

Time Correction of Anti-Aliasing Filters Used in Digital Audio Systems John Meyer 132
Vertical Modulation Angles of Commercial Stereo Phonograph Records Alan P. Woodard 138
Squealer-Killer with Real-Time Equalization J. Rodney Cox 144

CORRECTION

Correction to "Some Factors Affecting the Performance of Airline Entertainment Headsets" 150

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 75(1), pp. 296-298, 1984 January) 151

FEATURES

2nd AES Conference: The Art and Technology of Recording, Preliminary Program 158
—And the Music Went Round and Round on Rolls, Disks, or Reels . . . , Part 1 C. G. Nijssen 162

DEPARTMENTS

Review of Acoustical Patents 154
News of the Sections 179
Sound Track 184
Upcoming Meetings 184
New Products and Developments 186
Available Literature 188
Membership Information 189

Editorial Staff

Robert O. Fehr Editor
 Patricia M. Macdonald Managing Editor Abbie J. Cohen Senior Editor
 Ingeborg M. Stochmal Copy Editor Michael J. Ricca Production Editor
 G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 4, 1984 April.
 Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
 AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 4

1984 APRIL

PAPERS

Progress in Architectural Acoustics and Artificial Reverberation: Concert Hall Acoustics and Number Theory Manfred R. Schroeder 194
An Accurate and Easily Implemented Method of Modeling Loudspeaker Array Coverage John R. Prohs and David E. Harris 204
Acoustic Field in an Enclosure and Its Effect on Sound-Pressure Responses of a Loudspeaker Shinichi Sakai, Yukio Kagawa, and Tatsuo Yamabuchi 218
The Reflection Phase Grating Diffusor: Design Theory and Application Peter D'Antonio and John H. Konnerth 228

ENGINEERING REPORTS

Distortion in Positive- and Negative-Feedback Filters Oscar Juan Bonello 239
Amplitude and Frequency Modulation Distortions of a Loudspeaker Hideo Suzuki and Shigenori Shibata 246

LETTERS TO THE EDITOR

Comments on "Off-Axis Performance of Multiple Loudspeakers" Don Davis 254
Authors' Reply Rex Sinclair and Ted Uzzle 254

CORRECTION

Correction to "Fuzzy Distortion in Analog Amplifiers: A Limit to Information Transmission?" M. J. Hawksford 254

FEATURES

—And the Music Went Round and Round on Rolls, Disks, or Reels . . . , Part 2 C. G. Nijsen 262
Updates and Additions to 1984 AES International Sections Directory 274

DEPARTMENTS

Review of Acoustical Patents 255
News of the Sections 275
Upcoming Meetings 276
Sound Track 277
New Products and Developments 278
Available Literature 282
Membership Information 284
Audio Engineering Society Bylaws 289

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Ingeborg M. Stochmal Copy Editor
Abbie J. Cohen Senior Editor
Michael J. Ricca Production Editor
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schuelein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 5, 1984 May.
 Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA. Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$5.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
 AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 5

1984 MAY

PAPERS

Computer Simulation of Loudspeaker Directivity David G. Meyer 294
Dynamic Range Control of Digital Audio Signals G. W. McNally 316
Development of a Pickup Cartridge Villy Hansen 328

ENGINEERING REPORTS

Low-Frequency Sound Reproduction Mark E. Engebretson 340
Comparison of Real-Time Analysis and Time-Delay Spectrometry at Two Sound-Reinforcement Projects David Moore, Herb Chaudiere, and Bernie Cahill 347

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 75(3), pp. 1021–1026, 1984 March) 352

DEPARTMENTS

Review of Acoustical Patents 360
News of the Sections 366
Upcoming Meetings 372
Sound Track 374
New Products and Developments 378
Available Literature 382
Membership Information 384
Call For Papers—76th Convention, New York City, 1984 390

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Ingeborg M. Stochmal Copy Editor
Abbie J. Cohen Senior Editor
Michael J. Ricca Production Editor
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Mooror	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 6, 1984 June.
Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA. Telephone 212-661-2355.

Second-class postage paid at Utica, New York, USA.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50

Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 6

1984 JUNE

PAPERS

Efficient Editing of Digital Sound on Disk Curtis Abbott 394
FM Direct Stereo Decoder Kohji Ishida and Tatsuo Numata 403
Measurement and Prediction of the Timbre of Sound Reproduction Henrik Staffeldt 410

ENGINEERING REPORTS

Fully Balanced Bridge Amplifier Susumu Takahashi and Susumu Tanaka 415
The Church That Rocks and Rolls Glenn E. Meeks 422
A Topology to Linearize Miller-Effect Compensated Amplifiers Steven J. Gunderson 430

LETTERS TO THE EDITOR

Correction to "Phase Intermodulation Distortion—Instrumentation and Measurements" R. R. Cordell 435

FEATURES

1st Australian Regional Convention Preview 442
75th Convention Report 444
Exhibitors 454
Program 457
International Sections Meeting 470

DEPARTMENTS

Review of Acoustical Patents 436
News of the Sections 474
Sound Track 476
Upcoming Meetings 476
New Products and Developments 477
Available Literature 480
Abstracts of Interest 481
AES News 482
Membership Information 484

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor Abbie J. Cohen Senior Editor
Ingeborg M. Stochmal Copy Editor Michael J. Ricca Production Editor
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 7/8, 1984 July/August. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355. Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 7/8

1984 JULY/AUGUST

PAPERS

Direction-Sensitive Gating: A New Approach to Automatic Mixing Stephen Julstrom and Thomas Tichy 490
A Microphone Technique Applying the Principle of Second-Order-Gradient Unidirectionality Wieslaw R. Woszczyk 507

ENGINEERING REPORTS

Experiments Toward an Erasable Compact Disc Digital Audio System K. A. Schouhamer Immink and J. J. M. Braat 531
Digital Distortion Analyzer Eduard Stikvoort 539

LETTERS TO THE EDITOR

Comments on "Fuzzy Distortion in Analog Amplifiers: A Limit to Information Transmission?" J. Vanderkooy 542
Author's Reply M. J. Hawksford 542
Comments on "Direct Low-Frequency Driver Synthesis from System Specifications" Thomas L. Clarke 543

TECHNICAL COMMITTEE REPORTS

Report of the Meeting of the Technical Committee on Digital Audio (1984 March 26) Bart Locanthi 545

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 75(5), pp. 1653-1657, 1984 May) 548

FEATURES

Midwest Acoustics Conference (MAC 84) 554
76th Convention Preview 556
Exhibitors 557
Previews 558

DEPARTMENTS

News of the Sections 598
Upcoming Meetings 603
Sound Track 604
Available Literature 606
Membership Information 607
In Memoriam 618
AES Annual Report 619
Call For Papers—77th Convention, Hamburg, 1985 620
Communicating Through Poster Sessions Mahlon D. Burkhard 622
Information for Authors of Convention Papers 624

Editorial Staff

	Robert O. Fehr Editor	
Patricia M. Macdonald Managing Editor		Abbie J. Cohen Senior Editor
Michael J. Ricca Production Editor		Leslie A. Safford Associate Editor
Ingeborg M. Stochmal Copy Editor		Advertising/Special Publications
	G. Franklin Montgomery Consulting Technical Editor	

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogon	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 9, 1984 September. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at New York, New York, and at additional mailing office.

Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 9

1984 SEPTEMBER

PAPERS

Passive Three-Way All-Pass Crossover Networks Robert M. Bullock, III 626

On High-Density Recording of the Compact-Cassette Digital Recorder N. Sakamoto, T. Kogure, H. Kitagawa, and T. Shimada 640

Signal Processing of the Compact-Cassette Digital Recorder N. Sakamoto, T. Kogure, M. Shimbo, and H. Komae 647

Companded Predictive Delta Modulation: A Low-Cost Conversion Technique for Digital Recording Robert W. Adams 659

ENGINEERING REPORTS

Signal Power Spectrum Aspects in Loudspeaker Design H. Mayr 673

LETTERS TO THE EDITOR

Comments on "Optimum Loudspeaker Placement Near Reflecting Planes" Roy Allison 677

Author's Reply K. O. Ballagh 677

Editorial Note 678

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 76(1), pp. 331-333, 1984 July) 680

FEATURES

2nd International Conference: The Art and Technology of Recording Report 690

Exhibitors 709

DEPARTMENTS

Review of Acoustical Patents 686

News of the Sections 710

Sound Track 718

New Products and Developments 720

Available Literature 721

Upcoming Meetings 722

Abstracts of Interest 722

Membership Information 723

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor

Michael J. Ricca Production Editor **Leslie A. Safford** Associate Editor

Ingeborg M. Stochmal Copy Editor Advertising/Special Publications

G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blessner	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 10, 1984 October. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355. Second-class postage paid at New York, New York, and at additional mailing office.

Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 10

1984 OCTOBER

PAPERS

History of Electronic Sound Modification Harald Bode 730
Acoustic Impulse Response Measurement: A New Technique A. J. Berkhout, M. M. Boone, and C. Kesselman 740

ENGINEERING REPORTS

Digital Control of Loudspeaker Array Directivity David G. Meyer 747
A Study of High-Efficiency Audio Power Amplifiers Using a Voltage Switching Method Saburo Funada and Henry Akiya 755
Engineering Justifications for Selected Portions of the AES Recommended Practice for Specification of Loudspeaker Components Clifford A. Henricksen 763

STANDARDS AND RECOMMENDED PRACTICES

AES Recommended Practice for Specification of Loudspeaker Components Used in Professional Audio and Sound Reinforcement (Approved) 771
AES Recommended Practice for Professional Digital Audio Applications Employing Pulse-Code Modulation—Preferred Sampling Frequencies (Approved) 781
Standards News from JASA (Reprint, JASA, Vol. 76(3), pp. 989–995, 1984 September) 786

FEATURES

Review of Society's Sustaining Members 798

DEPARTMENTS

Review of Acoustical Patents 792
News of the Sections 820
Upcoming Meetings 823
Sound Track 824
New Products and Developments 825
Available Literature 828
Abstracts of Interest 829
AES News 830
Membership Information 831
Membership Application Form 838

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Michael J. Ricca Production Editor
Ingeborg M. Stochmal Copy Editor
G. Franklin Montgomery Consulting Technical Editor
Abbie J. Cohen Senior Editor
Leslie A. Safford Associate Editor
Advertising/Special Publications

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 11, 1984 November. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50. Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 11

1984 NOVEMBER

PAPERS

Perception of Phase Distortion in Anti-Alias Filters D. Preis and P. J. Bloom 842
Sound Synthesis by Fractional Waveshaping Giovanni De Poli 849
The Modified Hopkins-Stryker Equation Don Davis 862
The Wigner Distribution: A Valuable Tool for Investigating Transient Distortion Cornelis P. Janse and Arie J. M. Kaizer 868

ENGINEERING REPORTS

Digital Audio Modulation in the PAL and NTSC Optical Video Disk Coding Formats Kees A. Schouhamer Immink, Ad H. Hoogendijk, and Joost A. Kahlman 883

LETTERS TO THE EDITOR

Correction to "Resolution Below the Least Significant Bit in Digital Systems with Dither" John Vanderkooy and Stanley P. Lipshitz 889

FEATURES

Metric Review G. Franklin Montgomery 890
Educational Directory Update 901
AES Convention Schedule 904
1st Regional Convention Report 906
Exhibitors 914
Program 915

DEPARTMENTS

Review of Acoustical Patents 894
News of the Sections 922
Sound Track 928
Upcoming Meetings 929
New Products and Developments 930
Available Literature 931
Membership Information 932

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Michael J. Ricca Production Editor
Ingeborg M. Stochmal Copy Editor
G. Franklin Montgomery Consulting Technical Editor
Abbie J. Cohen Senior Editor
Leslie A. Safford Associate Editor
 Advertising/Special Publications

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 32, Number 12, 1984 December. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355. Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1984 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 32 NUMBER 12

1984 DECEMBER

PAPERS

A Perceptual Criterion for Loudspeaker Evaluation ... James M. Kates 938
Is Phase Linearization of Loudspeaker Crossover Networks Possible by Time Offset and Equalization?
 John Vanderkooy and Stanley P. Lipshitz 946
Loudspeaker Distortion Reduction
 R. A. Greiner and Travis M. Sims, Jr. 956

ENGINEERING REPORTS

Design Factors in a Programmable Distortion Measurement System
 Richard C. Cabot 964

FEATURES

Educational Directory Update 984
76th Convention Report 986
Exhibitors 996
Program 1000
International Sections Meeting 1016
New AES Officers 1984/85 1020
1985 AES Sections Directory 1023

DEPARTMENTS

News of the Sections 1030
Upcoming Meetings 1034
Sound Track 1034
New Products and Developments 1036
Available Literature 1038
Membership Information 1040
Call For Papers—78th Convention, Anaheim, 1985 1048
Index to Volume 32 1050

Editorial Staff

Robert O. Fehr Editor
 Patricia M. Macdonald Managing Editor
 Michael J. Ricca Production Editor
 Ingeborg M. Stochmal Copy Editor
 G. Franklin Montgomery Consulting Technical Editor
 Abbie J. Cohen Senior Editor
 Leslie A. Safford Associate Editor
 Advertising/Special Publications

Review Board

L. A. Abbagnaro R. C. Heyser S. P. Lipshitz D. Queen
 B. Blesser W. J. J. Hoge B. Locanthi M. R. Schroeder
 C. R. Cable J. M. Hollywood J. F. McGill R. B. Schulein
 R. C. Cabot T. Holman J. G. McKnight D. E. L. Shorter
 M. Camras J. M. Kates R. A. Moog R. H. Small
 D. H. Cooper D. L. Klepper J. A. Moorer E. L. Torick
 J. M. Eargle P. W. Klipsch J. T. Mullin J. Vanderkooy
 M. B. Gardner J. H. Kogen M. Polon D. R. von Recklinghausen
 R. A. Greiner W. M. Leach, Jr. D. Preis J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 1/2, 1985 January/February. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355. Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 1/2

1985 JANUARY/FEBRUARY

PAPERS

Subjective Measurements of Loudspeaker Sound Quality and Listener Performance Floyd E. Toole 2
Perceived Sound Quality of High-Fidelity Loudspeakers Alf Gabrielsson and Björn Lindström 33

LETTERS TO THE EDITOR

Comments on "A Versatile Delay Unit with CCDs" Alex Kish 54
Author's Reply Johan A. M. Catrysse 54

TECHNICAL COMMITTEE REPORTS

Minutes of the Meeting of the Digital Audio Technical Committee (1984 October 7) Bart N. Locanthi 55

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 76(5), pp. 1592-1597, 1984 November) 58

FEATURES

Educational Directory Update 64
77th Convention Preview 66
Exhibitors 67
Previews 68

DEPARTMENTS

News of the Sections 97
Upcoming Meetings 102
Sound Track 103
Available Literature 106
Membership Information 107
In Memoriam 112

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor
Michael J. Ricca Production Editor **Leslie A. Safford** Associate Editor
Ingeborg M. Stochmal Copy Editor Advertising/Special Publications
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 3, 1985 March.
 Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at New York, New York, and at additional mailing office.
 Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50
 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
 AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 3

1985 MARCH

PAPERS

Use of Frequency Overlap and Equalization to Produce High-Slope Linear-Phase Loudspeaker Crossover Networks Stanley P. Lipshitz and John Vanderkooy 114
Spectral, Phase, and Transient Equalization for Audio Systems P. M. Clarkson, J. Mourjopoulos, and J. K. Hammond 127
Refinements in the Impulse Testing of Loudspeakers L. R. Fincham 133

ENGINEERING REPORTS

An Efficient Algorithm for Generating Colored Noise Using a Pseudorandom Sequence Jeffrey Borish 141
A Tone-Burst Method for Measuring Loudspeaker Harmonic Distortion at High Power Levels Ding Yong-Sheng 145

STANDARDS

Operating Procedures of the Accredited Standards Committee (ASC) S4 on Audio Engineering 148
Standards News from JASA (Reprint, *JASA*, Vol. 77(1), pp. 328-332, 1985 January) 154

FEATURES

78th Convention Preview 162
Previews 164
Exhibitors 200

DEPARTMENTS

News of the Sections 201
Upcoming Meetings 206
Sound Track 206
Available Literature 208
Abstracts of Interest 209
Membership Information 210

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor **Abbie J. Cohen** Senior Editor
Michael J. Ricca Production Editor **Leslie A. Safford** Associate Editor
Ingeborg M. Stochmal Copy Editor Advertising/Special Publications
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 4, 1985 April.
Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at New York, New York, and at additional mailing office.
Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50
Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 4

1985 APRIL

PAPERS

From Instrument to Ear in a Room: Direct or via Recording A. H. Benade 218
Effect of Channel Separation on Earphone-Presented Tones, Noise, and Stereophonic Material Julie M. Adkins and Robert D. Sorkin 234

ENGINEERING REPORTS

Development of Technical Listening Skills: Timbre Solfeggio Tomasz Letowski 240
A "Split-Track" Recording Technique for Improved ENG Audio Skip Pizzi 245

LETTERS TO THE EDITOR

Comments on "Signal Power Spectrum Aspects in Loudspeaker Design" J. M. Woodgate 249
Author's Reply H. Mayr 249
Comments on "Low-Frequency Sound Reproduction" James B. Lee 249
Author's Reply Mark E. Engebretson 251

STANDARDS

Operating Policy of the Audio Engineering Society Standards Committee 253
Operating Procedures of the Audio Engineering Society Standards Committee 256

FEATURES

Educational Directory Update 260
History of Disk Recording John G. Frayne 263
A Brief History of Early Motion Picture Sound Recording and Reproducing Practices John K. Hilliard 271
AES Tokyo Conference 85: Present and Future of Digital Audio Engineering, Preliminary Program 279

DEPARTMENTS

Upcoming Meetings 283
News of the Sections 284
Sound Track 293
New Products and Developments 294
Available Literature 297
Membership Information 298
Audio Engineering Society Bylaws 306
Call for Papers—79th Convention, New York, 1985 310

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Michael J. Ricca Production Editor
Ingeborg M. Stochmal Copy Editor
G. Franklin Montgomery Consulting Technical Editor
Abbie J. Cohen Senior Editor
Leslie A. Safford Associate Editor
Advertising/Special Publications

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 5, 1985 May. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 5

1985 MAY

PAPERS

A New Approach to the Assessment of Stereophonic Sound System Performance J. C. Bennett, K. Barker, and F. O. Edeko 314
An Improved Computer Model of Direct-Radiator Loudspeakers I. C. Shepherd and R. J. Alfredson 322
An Auditorium Simulator for Domestic Use Jeffrey Borish 330

ENGINEERING REPORTS

Loudspeaker Directionality and the Perception of Reality Bert Berlant 342

COMMUNICATIONS

The Cantilever Sandwich Loudspeaker Diaphragm D. A. Barlow 351

LETTERS TO THE EDITOR

Comments on Education Panel Meeting in Hamburg Wagnanski Wladyslaw 355
Committee Comment Martin Polon 355
Corrections to "Passive Three-Way All-Pass Crossover Networks" Robert M. Bullock, III 355

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 77(3), pp. 1276-1281, 1985 March) 356

FEATURES

77th Convention Report 362
Exhibitors 374
Program 378
International Sections Meetings 396

DEPARTMENTS

Upcoming Meetings 400
News of the Sections 402
Sound Track 406
New Products and Developments 407
Available Literature 410
Membership Information 411
In Memoriam 416

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Michael J. Ricca Production Editor
Ingeborg M. Stochmal Copy Editor
G. Franklin Montgomery Consulting Technical Editor
Abbie J. Cohen Senior Editor
Leslie A. Safford Associate Editor
 Advertising/Special Publications

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Kiepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 6, 1985 June.
 Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at New York, New York, and at additional mailing office.
 Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright
 Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies
 Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50
 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues
 Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm
 Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication
 Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising
 For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts
 For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE AUDIO ENGINEERING SOCIETY

AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 6 1985 JUNE

PAPERS

The Parabolic Reflector as an Acoustical Amplifier Sten Wahlström 418

On the Design of Some Feedback Circuits for Loudspeakers J. A. M. Catrysse 430

The Subjective Importance of Uniform Group Delay at Low Frequencies L. R. Fincham 436

Low-Frequency Range Extension of Loudspeakers Daniel R. von Recklinghausen 440

ENGINEERING REPORTS

Closed-Box Loudspeaker System Equalization and Power Requirements Georgi Penkov and Boris Traianov 447

Control Room for Music Monitoring Ernst-Joachim Voelker 452

LETTERS TO THE EDITOR

Comments on "Determining the Acoustic Position for Proper Phase Response of Transducers" ... Stanley P. Lipshitz and John Vanderkooy 463

Author's Reply Richard C. Heyser 465

STANDARDS AND INFORMATION DOCUMENTS

Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment AES6-1982 (ANSI S4.3-1982) (Approved) 467

Method of Measuring Recorded Flux of Magnetic Sound Records at Medium Wavelengths AES7-1982 (ANSI S4.6-1982) (Approved) 477

FEATURES

Educational Directory Update 484

1985 Society of Automotive Engineers (SAE) Congress and Exposition David Clark 486

Midwest Acoustics Conference (MAC 85) Ted Staniec 488

DEPARTMENTS

News of the Sections 490

Upcoming Meetings 495

Sound Track 496

New Products and Developments 498

Available Literature 501

Membership Information 504

Membership Application Form 510

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor Abbie J. Cohen Senior Editor

Michael J. Ricca Production Editor Leslie A. Safford Associate Editor

Ingeborg M. Stochmal Copy Editor Advertising/Special Publications

G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 7/8, 1985 July/August. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355. Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE AUDIO ENGINEERING SOCIETY

AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 7/8

1985 JULY/AUGUST

PAPERS

Microphones Jon R. Sank 514
Basic Stereo Microphone Perspectives—A Review
 Ron Streicher and Wes Dooley 548

COMMUNICATIONS

A Bibliography of the Relevant Literature on the Subject of Microphones Richard Knoppow 557

TECHNICAL COMMITTEE REPORTS

Minutes of the Meeting of the Digital Audio Technical Committee (1985 March 4) Bart N. Locanthe 562

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 77(5), pp. 1968–1972, 1985 May) 566

FEATURES

78th Convention Report 572
Exhibitors 582
Program 584
International Sections Meeting 602

DEPARTMENTS

News of the Sections 604
Sound Track 610
Upcoming Meetings 610
New Products and Developments 611
Available Literature 613
Membership Information 616
In Memoriam 620
AES Annual Report 621
Call for Papers—80th Convention, Montreux, 1986 622
Information for Authors of Convention Papers 624

Editorial Staff

Robert O. Fehr Editor
Patricia M. Macdonald Managing Editor
Michael J. Ricca Production Editor
Ingeborg M. Stochmal Copy Editor
G. Franklin Montgomery Consulting Technical Editor
Abbie J. Cohen Senior Editor
Leslie A. Safford Associate Editor
 Advertising/Special Publications

Review Board

L. A. Abbagnaro	F. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthe	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 9, 1985 September. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355. Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 9

1985 SEPTEMBER

PAPERS

Increasing the Audio Measurement Capability of FFT Analyzers by Microcomputer Postprocessing Stanley P. Lipshitz, Tony C. Scott, and John Vanderkooy 626

Pre- and Postemphasis Techniques as Applied to Audio Recording Systems Louis D. Fielder 649

Root-Locus Technique for Vented-Box Loudspeaker Design Thomas E. Rutt 659

ENGINEERING REPORTS

Application of Walsh Functions to an FM Stereo Demodulator Susumu Takahashi and Hiroshi Iida 669

COMMUNICATIONS

Minimum-Phase-Shift Property of a One-Dimensional Triangular Source Hideo Suzuki 674

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 78 (1), pp. 278-281, 1985 July) 677

FEATURES

Educational Directory Update 681

Tokyo Conference: Digital Audio—The Present and Future Report 682

Program 688

79th Convention Preview 696

Previews 698

Exhibitors 738

Convention Workshop Report: "Is It Live Or Is It Digital?" David Clark 740

DEPARTMENTS

News of the Sections 742

Upcoming Meetings 746

Sound Track 747

Available Literature 749

Membership Information 750

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor Abbie J. Cohen Senior Editor
Michael J. Ricca Production Editor Leslie A. Safford Associate Editor
Ingeborg M. Stochmal Copy Editor Advertising/Special Publications
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 10, 1985 October. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 10

1985 OCTOBER

PAPERS

Tunable Active Crossover Networks Sanjit K. Mitra, Andrew J. Damonte, Nobuo Fujii, and Yrjö Neuvo 762
The Audibility of Modulation Noise in Floating-Point Conversion Systems L. D. Fielder 770
Perception of Phase Distortion in All-Pass Filters J. A. Deer, P. J. Bloom, and D. Preis 782

ENGINEERING REPORTS

Feedback Amplifier Output Stages Stephan J. G. Gift 787
Comments on "Feedback Amplifier Output Stages" Edward M. Cherry and Gregory K. Cambrell 795
Author's Reply Stephan J. G. Gift 799
Design of Function Generators to Generate Specified Intermodulation Levels Muhammad Taher Abuelma 'Atti 801

LETTERS TO THE EDITOR

Comments on "A Perceptual Criterion for Loudspeaker Evaluation" Søren Bech 805
Author's Reply James M. Kates 806
Comments on "On the Audibility of Midrange Phase Distortion in Audio Systems" H. R. E. van Maanen 806
Authors' Replies: D. Shanefield 808
..... James Moir 808
Comments on "Design Parameters Important for the Optimization of Very-High-Fidelity PWM (Class D) Audio Amplifiers" .. J. Vanderkooy 809
Comments on "Control Rooms for Music Monitoring" Don Davis 811

FEATURES

Review of Society's Sustaining Members 812

DEPARTMENTS

News of the Sections 836
Upcoming Meetings 840
Sound Track 840
New Products and Developments 842
Available Literature 845
Membership Information 847
Membership Application Form 854

Editorial Staff

Robert O. Fehr Editor

Patricia M. Macdonald Managing Editor Abbie J. Cohen Senior Editor
Michael J. Ricca Production Editor Leslie A. Safford Associate Editor
Ingeborg M. Stochmal Copy Editor Advertising/Special Publications
G. Franklin Montgomery Consulting Technical Editor

Review Board

L. A. Abbagnaro	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanthi	M. R. Schroeder
C. R. Cable	J. M. Hollywood	J. F. McGill	R. B. Schulein
R. C. Cabot	T. Holman	J. G. McKnight	D. E. L. Shorter
M. Camras	J. M. Kates	R. A. Moog	R. H. Small
D. H. Cooper	D. L. Klepper	J. A. Moorer	E. L. Torick
J. M. Eargle	P. W. Klipsch	J. T. Mullin	J. Vanderkooy
M. B. Gardner	J. H. Kogen	M. Polon	D. R. von Recklinghausen
R. A. Greiner	W. M. Leach, Jr.	D. Preis	J. V. White

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 11, 1985 November. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355.

Second-class postage paid at New York, New York, and at additional mailing office.

Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/84 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available at \$6.00 per copy; special issues \$10.00. For information, contact AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

For information on *Journal* advertising rates, deadlines, and mechanical requirements, contact the Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE AUDIO ENGINEERING SOCIETY

AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 11

1985 NOVEMBER

President's Message Robert B. Schulein 858

PAPERS

Ambisonics in Multichannel Broadcasting and Video Michael A. Gerzon 859
The Effect of Reinforcement System Regeneration on Gain and Reverberation Decay Ted Uzzle 872

ENGINEERING REPORTS

Improved Reed-Solomon Decoding Using Multiple-Pass Decoding D. Shenton, E. DeBenedictis, and B. Locanthi 878
Self-Contained Crosscorrelation Program for Maximum-Length Sequences Jeffrey Borish 888

COMMUNICATIONS

Duplication of the Sampling Frequency of Periodically Sampled Signals for the Calculation of the Discrete Wigner Distribution Hans R. E. van Maanen 892

STANDARDS

Standards News from JASA (Reprint, *JASA*, Vol. 78 (3), pp. 1142-1147, 1985 September) 899

FEATURES

Program Level Metering in Digital Audio Technology Horst Jakubowski 905
New AES Officers 1985/86 912

DEPARTMENTS

Review of Acoustical Patents 895
Upcoming Meetings 919
News of the Sections 920
Sound Track 924
New Products and Developments 928
Available Literature 932
Membership Information 933

Editorial Staff

Robert O. Fehr Editor
 Patricia M. Macdonald Managing Editor
 Michael J. Ricca Production Editor
 Ingeborg M. Stochmal Copy Editor
 G. Franklin Montgomery Consulting Technical Editor
 Abbie J. Cohen Senior Editor
 Leslie A. Safford Associate Editor
 Advertising/Special Publications

Review Board

L. A. Abbagnaro	R. A. Greiner	S. P. Lipshitz	K. A. Schouhamer-Immink
P. Berkhout	R. C. Heyser	B. Locanthi	M. R. Schroeder
B. Blesser	W. J. J. Hoge	J. F. McGill	R. B. Schulein
C. R. Cable	J. M. Hollywood	J. G. McKnight	D. E. L. Shorter
R. C. Cabot	T. Holman	R. A. Moog	R. H. Small
M. Camras	J. M. Kates	J. A. Moorer	E. L. Torick
D. H. Cooper	D. L. Klepper	J. T. Mullin	J. Vanderkoooy
R. T. Cordell	P. W. Klipsch	M. Polon	D. R. von Recklinghausen
J. M. Eargle	J. H. Kogen	D. Preis	J. V. White
M. B. Gardner	W. M. Leach, Jr.	D. Queen	E. Zaustinsky

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 33, Number 12, 1985 December. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355. Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1985 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/85 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available: From Volume 1 (1953) through Volume 12 (1964), \$15.00 per issue; Volume 13 (1965) to present, \$10.00 per issue. For information, contact the AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

Contact the AES Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

JOURNAL OF THE
AUDIO ENGINEERING SOCIETY
AUDIO / ACOUSTICS / APPLICATIONS

VOLUME 33 NUMBER 12

1985 DECEMBER

PAPERS

Improving the Signal-to-Noise Ratio and Coverage of FM Stereophonic Broadcasts Emil L. Torick and Thomas B. Keller 938
Reentrant Compression and Adaptive Expansion for Optimized Noise Reduction Daniel W. Gravereaux, David W. Stebbings, Jeffrey B. Kadin, and Aldo G. Cugnini 944
Subjective and Predictive Measures of Speech Intelligibility—The Role of Loudspeaker Directivity Kenneth D. Jacob 950
Sound Radiation from a Concave or a Convex Dome in a Semi-Infinite Tube Hideo Suzuki 956

ENGINEERING REPORTS

Three-Level Tone Test Signal for Setting Audio Levels ... A. N. Thiele 963

LETTERS TO THE EDITOR

More on "Human Stress Provoked by Digitalized Recordings" John Diamond 968
Reply Roger Lagadec 968
History of Companies Ted Uzzle 969
Comments on "Microphones" Peter Larsen 969
Author's Reply Jon R. Sank 969
Comments on "Loudspeaker Directionality and the Perception of Reality" David Moran 969

STANDARDS AND INFORMATION DOCUMENTS

Standards News from JASA (Reprint, *JASA*, Vol. 78 (5), pp. 1917–1921, 1985 November) 970
AES Recommended Practice for Digital Audio Engineering—Serial Transmission Format for Linearly Represented Digital Audio Data ... 975

FEATURES

79th Convention Report 986
Exhibitors 1000
Program 1004
1986 AES International Sections Directory 1019

DEPARTMENTS

News of the Sections 1026
Sound Track 1029
Upcoming Meetings 1032
New Products and Developments 1033
Available Literature 1035
Abstracts of Interest 1037
Membership Information 1038
Index to Volume 33 1042

Editorial Staff

Robert O. Fehr Editor
 Patricia M. Macdonald Managing Editor
 Michael J. Ricca Production Editor
 Ingeborg M. Stochmal Copy Editor
 G. Franklin Montgomery Consulting Technical Editor
 Abbie J. Cohen Senior Editor
 Leslie A. Safford Associate Editor
 Advertising/Special Publications

Review Board

L. A. Abbagnaro	R. A. Greiner	S. P. Lipshitz	K. A. Schouhamer-Immink
P. Berkhout	R. C. Heyser	B. Locanthe	M. R. Schroeder
B. Blesser	W. J. J. Hoge	J. F. McGill	R. B. Schuler
C. R. Cable	J. M. Hollywood	J. G. McKnight	D. E. L. Shorter
R. C. Cabot	T. Holman	R. A. Moog	R. H. Small
M. Camras	J. M. Kates	J. A. Moorer	E. L. Torick
D. H. Cooper	D. L. Klepper	J. T. Mullin	J. Vanderkooy
R. T. Cordell	P. W. Klipsch	M. Polon	D. R. von Recklinghausen
J. M. Eargle	J. H. Kogen	D. Preis	J. V. White
M. B. Gardner	W. M. Leach, Jr.	D. Queen	E. Zautinsky

Journal of the Audio Engineering Society (ISSN 0004-7554), Volume 34, Number 1/2, 1986 January/February. Published monthly, except January/February and July/August when published bimonthly, by the Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075, USA, Telephone 212-661-2355. Second-class postage paid at New York, New York, and at additional mailing office. Postmaster: Send address corrections to Audio Engineering Society, 60 East 42nd Street, New York, New York 10165-0075.

The Audio Engineering Society is not responsible for statements made by its contributors.

Copyright

Copyright © 1986 by the Audio Engineering Society, Inc. It is permitted to quote from this *Journal* with customary credit to the source.

Copies

Individual readers are permitted to photocopy isolated articles for research or other noncommercial use. Permission to photocopy for internal or personal use, or the internal or personal use of specific clients, is granted by the Audio Engineering Society to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$1.00 per copy plus \$0.50 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970, USA. 0004-7554/86 \$1.00 + .50 Photocopies of individual articles may be ordered from the AES Headquarters office at \$3.00 per article.

Back Issues

Selected back issues are available: From Volume 1 (1953) through Volume 12 (1964), \$15.00 per issue; Volume 13 (1965) to present, \$10.00 per issue. For information, contact the AES Headquarters office.

Microfilm

Copies of Volume 19, Number 1 (1971 January) to the present edition are available on microfilm from University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, USA.

Reprints and Republication

Multiple reproduction or republication of any material in this *Journal* requires the permission of the Audio Engineering Society. Permission may also be required from one of the authors. Inquiries should be sent to the AES Editorial office.

Advertising

Contact the AES Editorial office.

Manuscripts

For information on the presentation and processing of manuscripts, see inside back cover.

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY

AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 34 NUMBER 1/2

1986 JANUARY/FEBRUARY

Editor's Message Robert O. Fehr 2

PAPERS

Digital Dynamic Range Compressor for Audio E. F. Stikvoort 3
 Subjective Evaluation of Dynamic Compression in Music W. M. Wagenaars, A. J. M. Houtsma, and R. A. J. M. van Lieshout 10
 Transient Intermodulation Distortion—Part 2: Soft Nonlinearity Edward M. Cherry and Kishor P. Dabke 19

ENGINEERING REPORTS

Review of Frequencies and Levels for Digital Audio Performance Measurements Robert A. Finger 36

LETTERS TO THE EDITOR

Correction to "Ground-Plane Acoustic Measurement of Loudspeaker Systems" Mark R. Gander 49

STANDARDS

Standardization in Professional Digital Audio Engineering at the AES Bart N. Locanthi 50

FEATURES

80th Convention Preview 58
 Previews 60
 Exhibitors 86

DEPARTMENTS

Review of Acoustical Patents 55
 News of the Sections 90
 Sound Track 97
 Upcoming Meetings 99
 Available Literature 99
 Membership Information 101
 In Memoriam 109
 Call for Papers—81st Convention, Los Angeles, 1986 110
 Information for Authors of Convention Papers 112

Editorial Staff

Robert O. Fehr Editor
 Patricia M. Macdonald Managing Editor
 Michael J. Ricca Production Editor
 Ingeborg M. Stochmal Copy Editor
 G. Franklin Montgomery Consulting Technical Editor
 Abbie J. Cohen Senior Editor
 Leslie A. Safford Associate Editor
 Advertising/Special Publications

Review Board

L. A. Abbagnaro	R. A. Greiner	S. P. Lipshitz	K. A. Schouhamer-Immink
P. Berkhout	R. C. Heyser	B. Locanthi	M. R. Schroeder
B. Blesser	W. J. J. Hoge	J. F. McGill	R. B. Schulein
C. R. Cable	J. M. Hollywood	J. G. McKnight	D. E. L. Shorter
R. C. Cabot	T. Holman	R. A. Moog	R. H. Small
M. Camras	J. M. Kates	J. A. Moorer	E. L. Torick
D. H. Cooper	D. L. Klepper	J. T. Mullin	J. Vanderkooy
R. T. Cordell	P. W. Klipsch	M. Polon	D. R. von Recklinghausen
J. M. Eargle	J. H. Kogen	D. Preis	J. V. White
M. B. Gardner	W. M. Leach, Jr.	D. Queen	E. Zautinsky

CONTENTS

PAPERS

- Numerical Optimization of the Crossover Filters in a Multiway Loudspeaker System** R. P. de Wit, A. J. M. Kaizer, and F. J. Op de Beek 115
Given the measured impedances and acoustic responses of a set of drivers and the overall target responses for a loudspeaker system, one can obtain optimal designs for the crossover networks.
- Design of Optimized Loudspeaker Crossover Networks Using a Personal Computer** Peter L. Schuck 124
Ladder filter networks are minimum phase, and dynamic drivers are substantially so. Reliance on this property simplifies the practical optimization of crossover networks with a small computer.
- Linear-Phase Bandsplitting: Theory and Applications** James A. Moorer and Mark Berger 143
A bank of band-pass filters can be realized whose output sum exhibits a constant delay at all frequencies. The usefulness of this possibility is explored.
- Design and Implementation of an Audio 18-Bit Analog-to-Digital Converter Using Oversampling Techniques** Robert W. Adams 153
Successive-approximation analog-to-digital converters are limited by achievable settling time, sample droop, and input noise. The limitations can be stretched by oversampling and return to a lower sampling rate.

ENGINEERING REPORTS

- The Localized Sound Power Method** Earl Geddes and Henry Blind 167
Stable acoustic equalization of an enclosed space is accomplished with multipoint measurements. The method is applied to an automobile interior.

STANDARDS

- Standards News from JASA** (Reprint, JASA, Vol. 79(1), pp. 200-202, 1986 January) 174

TECHNICAL COMMITTEE REPORTS

- Minutes of the Meeting of the Digital Audio Technical Committee** (1985 October 11) Bart N. Locanthi 179

FEATURES

- 4th AES International Conference: Stereo Audio Technology for Television and Video—Preliminary Program** 185
- Stereo Television: Market Forces and Issues** Martin Polon 188

DEPARTMENTS

- | | |
|--|---|
| Educational Directory Update 184 | Available Literature 216 |
| News of the Sections 205 | Membership Information 218 |
| Sound Track 212 | In Memoriam 222 |
| Upcoming Meetings 213 | Call for Papers—81st Convention, Los Angeles, 1986 223 |
| New Products and Developments 214 | |

CONTENTS

PAPERS

- Loudspeaker Measurements and Their Relationship to Listener Preferences: Part 1** Floyd E. Toole 227
Few agree generally on which objective loudspeaker measurements correlate well with audible quality. The author reviews the diverse history of findings and opinions.
- Power Response of Loudspeakers with Noncoincident Drivers—The Influence of Crossover Design** John Vanderkooy and Stanley P. Lipshitz 236
With separated drivers, axial response depends upon the type of crossover. Improved power (reverberant) response requires a compromise of axial behavior.
- Impulse Measurement of Horn-Type Loudspeaker Drivers** Josef Merhaut 245
The characteristics a driver would exhibit when driving an infinite horn can be measured using a finite-length waveguide.
- Spaciousness and Localization in Listening Rooms and Their Effects on the Recording Technique** David Griesinger 255
The quality of stereophonic reproduction can be enhanced by recording with coincident microphones and by equalizing L + R and L - R signals separately. Experimental results are reported.
- A Graphic Method for Choosing and Aiming Loudspeakers for Reinforcement** Peter W. Tappan 269
For a given loudspeaker position and directional characteristic, rapid calculation of listening-area sound pressure levels can be made with a graphic template appropriately scaled to the architectural drawings.

STANDARDS

- Standards News from JASA** (Reprint, JASA, Vol. 79(3), pp. 876-880, 1986 March) 280

FEATURES

- 1986 Society of Automotive Engineers (SAE) Congress and Exposition** David Clark 285

DEPARTMENTS

- | | | | |
|--|-----|---|-----|
| Review of Acoustical Patents | 278 | Available Literature | 300 |
| News of the Sections | 290 | Abstracts of Interest | 301 |
| Sound Track | 294 | Membership Information | 302 |
| Upcoming Meetings | 296 | Audio Engineering Society Bylaws | 307 |
| New Products and Developments | 297 | Call for Papers—81st Convention, Los Angeles, 1986 | 311 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 34 NUMBER 5

1986 MAY

CONTENTS

PAPERS

- A New Three-Way All-Pass Crossover Network Design** Robert M. Bullock III 315
A three-way network can be realized either passively or actively to produce rapid attenuation with little or no increase in component cost.

- Loudspeaker Measurements and Their Relationship to Listener Preferences: Part 2**
 Floyd E. Toole 323
The history of the problem was discussed in Part 1 (April). Recent experiments show reliable correlation of listener preferences with high-resolution measurements of amplitude response.

ENGINEERING REPORTS

- Amplifier First-Stage Criteria for Avoiding Slew-Rate Limiting** Peter Garde 349
Designing a first stage to accommodate a full-input step is unnecessarily conservative. Milder criteria permit better performance.

LETTERS TO THE EDITOR

- Comments on "An Amplifier Input Stage Design Criterion for the Suppression of Dynamic Distortions"** Peter Garde 354
Author's Reply W. Marshall Leach, Jr. 355

FEATURES

- 80th Convention Report** 362
 Exhibitors 376
 Program 378
International Sections Meeting 392
MIDI: Musical Instrument Digital Interface Bob Moog 394

DEPARTMENTS

- | | |
|---|---|
| Review of Acoustical Patents 360 | New Products and Developments 413 |
| News of the Sections 405 | Available Literature 416 |
| Upcoming Meetings 410 | Membership Information 417 |
| Sound Track 411 | Call for Papers—81st Convention, Los Angeles, 1986 423 |

CONTENTS

PAPERS

- Total Difference-Frequency Distortion: Practical Measurements** Richard H. Small 427
A proposed IEC distortion measurement is realized by a distortion meter that has been used to test sample amplifiers, tape recorders, and a loudspeaker. Distortion sensitivity extends to 0.0001 percent.
- Type 1 and Type 2 Errors in the Statistical Analysis of Listening Tests** Les Leventhal 437
Improper design of a listening test increases the risk of finding real component differences inaudible (compared with the risk of imagining differences where none exist). The author provides statistical guidance.
- The Digital Audio Processing Station: A New Concept in Audio Postproduction**
 James A. Moorer, Curtis Abbott, Peter Nye, Jeffrey Borish, and John Snell 454
Digital sound is stored, manipulated, and reassembled in the studio entirely under software control. The composer and sound editor now have an agile and noiseless "word processor" that replaces tape-splicing and other traditional procedures.

ENGINEERING REPORTS

- Source Radiation Characteristics** Earl R. Geddes 464
The author calculates axially symmetric patterns for flat, convex, and acoustic lens sources.
- Design of a Digital Biquadratic Peaking or Notch Filter for Digital Audio Equalization**
 Stanley A. White 479
Frequency, bandwidth, and boost (or attenuation) are the parameters whose choices begin the design of this filter.

STANDARDS

- Standards News from JASA** (Reprint, JASA, Vol. 79(5), pp. 1630-1635, 1986 May) 484

FEATURES

- An Overview of Stereo Recording Techniques for Popular Music** John M. Eargle 490

DEPARTMENTS

- | | | | |
|-----------------------------------|-----|--|-----|
| News of the Sections | 505 | New Products and Developments | 513 |
| Sound Track | 510 | Available Literature | 515 |
| Upcoming Meetings | 512 | Membership Information | 516 |
| In Memoriam | 520 | | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 34 NUMBER 7/8

1986 JULY/AUGUST

CONTENTS

PAPERS

Another Approach to Time-Delay Spectrometry John Vanderkooy 523
Complete specification of a linear system is given by a proper measurement of either impulse response or complex transfer function. The author explores the relationship and equivalence of time-delay spectrometry to these classical measures.

Diffusing Surfaces in Concert Halls: Boon or Bane? Jeffrey Borish 539
Ought one to strive for concert-hall reflections that are specular or diffuse? The path from analysis to subjective perception is not yet clear-cut.

ENGINEERING REPORTS

Selection of Test Signals for DSP-Based Testing of Digital Audio Systems Joel M. Halbert and R. Allan Belcher 546
Distortion and noise products in digital systems differ peculiarly from those in analog systems. Digital hardware requires test measurements other than those for harmonic distortion.

A Subtractive Implementation of Linkwitz-Riley Crossover Design R. Chalupa 556
Active second-order and fourth-order crossover networks are realized with some economy of precision components.

LETTERS TO THE EDITOR

Comments on "Improving the Signal-to-Noise Ratio and Coverage of FM Stereophonic Broadcasts" Rob Lewis 560

Comments on "Stereo Television: Market Forces and Issues" Randy Hoffner 560

Comments on "Subjective and Predictive Measurements of Speech Intelligibility—The Role of Loudspeaker Directivity" Farrel M. Becker 560

Additional Comments Don Davis 561

Author's Reply Kenneth D. Jacob 562

CORRECTIONS

Correction to "Design of Optimized Loudspeaker Crossover Networks Using a Personal Computer" 563

TECHNICAL COMMITTEE REPORTS

Minutes of the Meeting of the Digital Audio Technical Committee (1986 March 3) Bart N. Locanthi 565

STANDARDS

Draft AES Information Document—Plane-Wave Tubes: Design and Practice (insert)

FEATURES

4th International Conference Report 578
Program 586

DEPARTMENTS

News of the Sections 592	Membership Information 601
Upcoming Meetings 596	AES Annual Report 605
Sound Track 597	Call for Papers—82nd Convention, London, 1987 606
New Products and Developments 598	Information for Authors of Convention Papers 608
Available Literature 600	

CONTENTS

PAPERS

- Constant-Q Graphic Equalizers** Dennis A. Bohn 611
A graphic equalizer ought to produce a frequency response that mimics the positions of its frequency controls. Conventional equalizers do not achieve this result. Constant-Q equalizers do.
- Dynamic Linearity and Power Compression in Moving-Coil Loudspeakers** Mark R. Gander 627
Loudspeaker sensitivity and linearity vary with signal amplitude. Some variations are caused by design particulars of the moving-coil motor, the enclosure, and the enclosure port or passive radiator, if any.
- Effects of Receiver Design and Transmission Impairments on Audio Signal Quality in the BTSC System for Multichannel Television Sound** J. James Gibson 647
Distortion, crosstalk, and 60-Hz buzz are potential faults in multichannel television sound. They are curbed satisfactorily by careful design and operation of the receiver and transmitter.

COMMUNICATIONS

- Digital Reverberation Time Meter** Arif A. R. Aljudi and Majid A. H. Abdul-Karim 661
Conventional electronic circuits combine to yield a digital display of reverberation time.

LETTERS TO THE EDITOR

- Comments on "A Graphic Method for Choosing and Aiming Loudspeakers for Reinforcement"**
 Peter W. Tappan 664

CORRECTIONS

- Correction to "Type 1 and Type 2 Errors in the Statistical Analysis of Listening Tests"** 664

STANDARDS

- Standards News from JASA** (Reprint, JASA, Vol. 80(1), pp. 359-363, 1986 July) 665

FEATURES

- 81st Convention Preview** 674
 Previews 676
 Exhibitors 714
- Stereo Microphone Techniques: Are the Purists Wrong?** Stanley P. Lipshitz 716

DEPARTMENTS

- | | |
|---|--|
| Review of Acoustical Patents 670 | Abstracts of Interest 756 |
| News of the Sections 745 | Membership Information 757 |
| Sound Track 749 | In Memoriam 763 |
| Upcoming Meetings 752 | Call for Papers—82nd Convention,
London, 1987 764 |
| Available Literature 753 | Membership Application Form 766 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 34 NUMBER 10

1986 OCTOBER

CONTENTS

PAPERS

- Application of the Geometric Theory of Diffraction (GTD) to Diffraction at the Edges of Loudspeaker Baffles** R. M. Bews and M. J. Hawksford 771
Steady-state and step sound pressures are calculated for a radiator in a small baffle. Diffractive interference is reduced in geometrically irregular designs.
- Mutual Radiation Impedance of a Double-Disk Source and Its Effect on the Radiated Power** Hideo Suzuki 780
Radiated power of a pair of radiators is calculated, including the contribution of the mutual radiation impedance. The results are pertinent in designing a two-way loudspeaker.
- Psychoacoustic Considerations in the Design of Studio Control Rooms** Jack Wrightson 789
A satisfactory control room is one whose acoustic responses nearly disappear. Complete disappearance is undesirable, but the effects that remain should be manipulated differently from current practice.
- Influence of Rear-Wall Reflection Patterns in Live-End-Dead-End-Type Recording Studio Control Rooms** Jack Wrightson and Russ Berger 796
Strong control-room reflections degrade spatial perception, a conclusion confirmed by psychoacoustical experiment. A designer's preference for such reflections may arise from misinterpretation of the literature.

ENGINEERING REPORTS

- A Five-Band Companded Technique for Converting Telephone Quality to Broadcast Quality Using Two Voice-Grade Phone Lines** Daniel B. Talbot and John F. Cheney 804
A voice channel, preemphasized, divided into five bands, and suitably compressed, is reassembled at the receiving end of two telephone lines to yield a 50-Hz to 5-kHz response with a perceived 60-dB signal-to-noise ratio.

STANDARDS

- Standards News from JASA** (Reprint, JASA, Vol. 80(3), pp. 985-989, 1986 September) 812

FEATURES

- 81st Convention Update** 818
- The AES Technical Council: Its Form and Function** Daniel Queen 820
- Review of Society's Sustaining Members** 824

DEPARTMENTS

- | | | | |
|--|-----|--|-----|
| News of the Sections | 849 | Available Literature | 859 |
| Upcoming Meetings | 852 | Membership Information | 860 |
| Sound Track | 853 | In Memoriam | 861 |
| New Products and Developments | 855 | Membership Application Form | 862 |

CONTENTS

PAPERS

Orchestral Instruments: Analysis of Performed Transitions John Strawn 867
Music is a sequence of tones and the transitions from one tone to the next. Melodic intervals performed on nine instruments reveal that a transition's power variation is to some extent independent of the instrument and of the size and direction of the interval.

Evaluation of Phase Shift and Group Delay in Phono Cartridges Using a Lumped-Parameter Mathematical Model Neil F. Albert 881
A mathematical model assists in the design of a linear-phase phonograph cartridge using conventional materials.

In-Phase Crossover Network Design Stanley P. Lipshitz and John Vanderkooy 889
Linkwitz-Riley networks are special cases of a class of all-pass alignments that produce no directional tilt in the loudspeaker's crossover region.

Sandwich-Construction Loudspeaker Diaphragm with Foamed High-Polymer and Carbon Fiber Sadao Taguchi, Toshio Watanabe, Eiichi Takahashi, Susumu Takahashi, and Susumu Tanaka 895
Carbon fiber and acrylic foam make a diaphragm material with greater stiffness than paper and approximately equal loss. Resonance frequencies are increased and distortion reduced.

ENGINEERING REPORTS

Measurement of %AL_{cons} Carolyn P. Davis 905
Two instrumental methods for measuring articulation correlate well. Speech intelligibility is seriously affected by the directivity factor and by loudspeaker misalignment.

FEATURES

Preparation of Master Tapes: A Producer's and Mixer's Guide to Mastering for Analog Disks, Cassettes, and Compact Discs Sidney Feldman 914

DEPARTMENTS

Review of Acoustical Patents	910	New Products and Developments	946
News of the Sections	942	Available Literature	948
Sound Track	944	Abstracts of Interest	949
Upcoming Meetings	944	Membership Information	950

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 34 NUMBER 12

1986 DECEMBER

CONTENTS

President's Message Bart N. Locanthi 955

PAPERS

On the Standardization of the Frequency Response of High-Quality Studio Headphones Günther Theile 956
Perceived loudness and timbre of an acoustic source are modified by the external ear and by psychological processes. These findings argue for headphone equalization that duplicates ear-canal response to a diffuse sound field.

Electrodynamic Loudspeaker with Baffle: Motional Impedance and Radiation A. M. Bruneau and M. Bruneau 970
The authors compare theoretical and experimental results for sound pressure and motional impedance of a dynamic driver, baffled and unbaffled.

ENGINEERING REPORTS

The "Acoustic Resistance Box"—A Fresh Look at an Old Principle Thomas J. Holmes 981
A woofer, mounted in a box with a resistive port, produces a unidirectional response. The combination is particularly adaptable for use with motional feedback.

A Psychoacoustically Optimized Loudspeaker ... Kenneth L. Kantor and Alexander P. de Koster 990
The ideal loudspeaker must deliver both a correct first-arrival signal and a correct ambient signal, adjustable and suitably delayed. A system of direct and ambient radiators approaches this ideal.

LETTERS TO THE EDITOR

Comments on "Three-Level Tone Test Signal for Setting Audio Levels" Don Davis 997
Author's Reply A. N. Thiele 997

CORRECTIONS

Correction to "Type 1 and Type 2 Errors in the Statistical Analysis of Listening Tests" 998

FEATURES

81st Convention Report 1002
Exhibitors 1016
Program 1021
New AES Officers 1986-1987 1040
1987 AES International Sections Directory 1045

DEPARTMENTS

Review of Acoustical Patents 1000	Membership Information 1062
News of the Sections 1053	In Memoriam 1063
Sound Track 1056	Call for Papers—AES 2nd Regional Convention, Tokyo, 1987 1064
Upcoming Meetings 1056	Index to Volume 34 1066
New Products and Developments 1057	Convention Schedule 1072
Available Literature 1060	

CONTENTS

PAPERS

- Analysis and Synthesis of Musical Transitions Using the Discrete Short-Time Fourier Transform** John Strawn 3
A study of tone-to-tone transitions was reported in 1986 November. Here, selected uses of the Fourier transform generate resynthesized transitions that are audibly indistinguishable from their originals.
- Mathematical Noise Modeling and Analysis of Some Popular Preamplifier Circuit Topologies** T. F. Darling 15
Analyzing the noise performance of several moving-coil phonograph preamplifiers suggests a preferred circuit.

ENGINEERING REPORTS

- Active RC Crossover Networks with Adjustable Characteristics** Phillip A. Regalia, Nobuo Fujii, Sanjit K. Mitra, and Yrjö Neuvo 24
Two active, tunable crossovers exhibit both constant-amplitude and constant-power network responses.
- A Combined Measurement Method for Both Dynamic Intermodulation and Static Nonlinear Distortions** Paul Skritek 31
A test signal composed of a filtered square wave and high-frequency sinusoid discovers both static and dynamic nonlinearities. Its frequency spectrum and amplitude distribution resemble those of natural signals.
- Linear-Phase Digital Audio Tone Control** Y. C. Lim 38
A relatively simple linear-phase digital filter is proposed to replace the analog tone control.

STANDARDS

- Standards News from JASA** (Reprint, JASA, Vol. 80(5), pp. 1551-1556, 1986 November) 41

FEATURES

- 82nd AES Convention Preview** 50
 Exhibit Previews 52
 Exhibitors 64
- 5th AES International Conference: Music and Digital Technology** 77

DEPARTMENTS

- | | |
|---|--|
| Review of Acoustical Patents 47 | Available Literature 87 |
| News of the Sections 78 | Membership Information 90 |
| Sound Track 84 | Call for Papers—83rd AES |
| Upcoming Meetings 86 | Convention, New York, 1987 93 |
| AES Conventions and Conferences 96 | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 35 NUMBER 3

1987 MARCH

CONTENTS

PAPERS

- The Spectral Recording Process** Ray Dolby 99
Signal compression-expansion is inaudible if the large-amplitude frequency components are modulated selectively without affecting component amplitudes in the remainder of the spectrum. Realizing this principle yields a superior method for avoiding distortion and noise in the recording or transmitting channel.

- The Acoustics and Sound System for Hemispherical Film Projection** Peter H. Heringa, Ben H. M. Kok, and Yves Dekeyrel 119
In a space theater, visual and auditory images must appear to coincide. Systems designed to steer the audio image in range and position have been chosen for theaters in Paris and The Hague.

- CD Direct Metal Mastering Technology: A Step Toward a More Efficient Manufacturing Process for Compact Discs** Horst Redlich and Günter Joschko 130
Modifications of the direct metal technique for mastering phonograph records make it possible to produce Compact Disc masters by a similar mechanical process.

- Production of Spatially Limited "Diffuse" Sound Field in an Anechoic Room** Ivar Veit and Harald Sander 138
The random sound field of a reverberation room is simulated in an anechoic environment using an appropriate loudspeaker array and independent signals.

LETTERS TO THE EDITOR

- More on "Impulse Measurement of Horn-Type Loudspeaker Drivers"** Josef Merhaut 144
Comments on "Another Approach to Time-Delay Spectrometry" Henrik Biering and Ole Z. Pedersen 145
Author's Reply John Vanderkooy 146

STANDARDS

- Standards News from JASA** (Reprint, JASA, Vol. 81(1), pp. 200-202, 1987 January) 147

FEATURES

- 5th AES International Conference: Music and Digital Technology—Preliminary Program** 154
Personal Computers and Music: The State of the Art Christopher Yavelow 160

DEPARTMENTS

- | | | | |
|--|-----|--|-----|
| Review of Acoustical Patents | 150 | Available Literature | 200 |
| News of the Sections | 194 | Membership Information | 201 |
| Upcoming Meetings | 196 | Call for Papers—83rd AES | |
| Sound Track | 196 | Convention, New York, 1987 | 206 |
| New Products and Developments | 198 | AES Conventions and Conferences | 208 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 35 NUMBER 4

1987 APRIL

CONTENTS

PAPERS

- A Boundary-Element Approach to Finite-Element Radiation Problems** Earl Geddes, James Porter, and Yifan Tang 211
With a wise choice of radiation boundary, finite-element analysis of loudspeaker response becomes accurate and efficient.
- A Hybrid Approach to the Variable-Speed Replay of Digital Audio** P. S. Gaskell 230
Digital audio is replayed at speeds from standstill to 20 times normal while low-speed in-band images and high-speed out-of-band components are eliminated.
- Active Realization of Multiway All-Pass Crossover Systems** Joseph A. D'Appolito 239
Any N-way, sum-to-all-pass crossover can be realized as a branched cascade of N - 1 two-way, all-pass crossovers with phase-compensating networks.
- A Century of Microphones** B. B. Bauer 246
The technique, beginning in 1860, of using a diaphragm to convert sound waves to electricity is still in flux in 1962.

MESSAGE TO MEMBERS

- Richard C. Heyser (1931-1987) 259

LETTERS TO THE EDITOR

- The Proposed DAT Bill Bart Locanthi 259

FEATURES

- AES 2nd Regional Convention: Advanced Audio Technology for Better Sound** 266
- An Early Auditory Training System** Samuel F. Lybarger 270

DEPARTMENTS

- | | | | |
|-------------------------------|-----|----------------------------------|-----|
| News of the Sections | 276 | Membership Information | 286 |
| Upcoming Meetings | 280 | Audio Engineering Society Bylaws | 290 |
| Sound Track | 281 | Call for Papers—83rd AES | |
| New Products and Developments | 283 | Convention, New York, 1987 | 294 |
| Available Literature | 285 | AES Conventions and Conferences | 296 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 35 NUMBER 5

1987 MAY

CONTENTS

PAPERS

Statistical Parameters of the Frequency Response Curves of Large Rooms M. R. Schroeder 299
For a large (irregular) auditorium, theory predicts room-response peaks averaging 10 dB in height and with average frequency separations proportional to the inverse of reverberation time.

Normal Frequency and Excitation Statistics in Rooms: Model Experiments with Electric Waves M. R. Schroeder 307
Room response is studied experimentally with a microwave analog. Randomness of response and excitation requires rooms with only small geometric irregularities or small perturbing structures.

Unified Compressor Measurements by Using a Channel Simulator Paul Skritek 317
Compressor behavior is observed in a channel that is adjustable for bandwidth, frequency response, phase response, frequency-dependent overload and dropouts, and levels of additive and modulation noise and interference.

Editing Time-Varying Spectra John Strawn 337
A large data load must be manipulated in examining and modifying the tone spectra of musical instruments. Shown here are some of the capabilities of an editor devised for short-time Fourier-transform data.

LETTERS TO THE EDITOR

Is Reel-to-Reel Digital Standardization Really Necessary Any More? Stephen F. Temmer 353
Filibuster Feature Dan Dugan 354

CORRECTIONS

Correction to "Comments on 'Three-Level Tone Test Signal for Setting Audio Levels'" 354

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 81(3), pp. 800-803, 1987 March) 355

FEATURES

82nd Convention Report 362
 Exhibitors 374
 Program 379
Updates and Additions to 1987 AES International Sections Directory 398

DEPARTMENTS

Educational Directory Update	359	Available Literature	406
News of the Sections	396	Membership Information	407
Sound Track	399	In Memoriam	413
Upcoming Meetings	400	Call for Papers—83rd AES	
Abstracts of Interest	401	Convention, New York, 1987	416
New Products and Developments	402	AES Conventions and Conferences	418

CONTENTS

PAPERS

Modeling of the Nonlinear Response of an Electrodynamical Loudspeaker by a Volterra Series Expansion A. J. M. Kaizer 421

An approximate integral equation predicts the nonlinear behavior of a low-frequency driver. Experiment generally confirms the analysis.

On the Use of Computer-Generated Dithered Test Signals Robert A. Finger 434

Rigorous measurement (and subjective evaluation) of digital nonlinear distortion may be impossible using nondithered test signals. Dithered signals selected for a test Compact Disc are suggested by experience with dither of different probability densities.

The Application of Narrow-Band Dither Operating at the Nyquist Frequency in Digital Systems to Provide Improved Signal-to-Noise Ratio over Conventional Dithering Barry A. Blesser and Bart N. Locanthi 446

Experiment shows that additive narrow-band dither at the Nyquist frequency linearizes the analog-to-digital converter while producing a noise floor lower than is found using additive baseband dither.

Peak Current Requirement of Commercial Loudspeaker Systems Matti Ojala and Pertti Huttunen 455

The typical 8-ohm loudspeaker's drivers and crossover networks combine to form reactive terminal impedances of other magnitudes. For a nonsinusoidal worst-case signal, amplifier current may equal that demanded by a 1-ohm resistive load.

ENGINEERING REPORTS

Reducing Off-Axis Comb-Filter Effects in Highly Directional Microphones Yuri Shulman 463

Predominantly resistive ports in the tube of a line microphone improve its on-axis and off-axis responses.

LETTERS TO THE EDITOR

CBS Technology Center: In Memoriam Emil L. Torick 471

CORRECTIONS

Correction to "Personal Computers and Music" 472

FEATURES

Audio Measurements Richard C. Cabot 476

MESSAGE TO MEMBERS

AES Changes in Europe 506

DEPARTMENTS

Review of Acoustical Patents 473	New Products and Developments 507
News of the Sections 502	Available Literature 508
Sound Track 505	Membership Information 509
Upcoming Meetings 506	AES Conventions and Conferences 514

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 35 NUMBER 7/8

1987 JULY/AUGUST

CONTENTS

PAPERS

- Evaluation of the Audible Distortion and Noise Produced by Digital Audio Converters** Louis D. Fielder 517
A measurement technique reveals low-level digital-converter nonlinearities. Distortion resulting from such defects is predictably audible when the masking and critical-band behavior of human hearing is accounted for.
- A High-Performance Surround Sound Process for Home Video** Stephen Julstrom 536
Home-video surround sound is realized with a processor that enhances directional information and delays the signal to the surround loudspeakers.

ENGINEERING REPORTS

- Sound Transmission Through Partitions** Marshall Long
Part 1: Diffuse Source Field 550
Part 2: Direct Source Field 552
Transmission from a source through a partition to a receiving space is analyzed for cases not properly treated by earlier theory.
- Computer Simulation of Horn-Loaded Compression Drivers** Earl Geddes and David Clark 556
Sound pressure, diaphragm displacement, and electrical impedance of a driver and finite horn are calculated using a computer model.

LETTERS TO THE EDITOR

- Comments on "Type 1 and Type 2 Errors in the Statistical Analysis of Listening Tests"**
 Daniel Shanefield 567
 David Clark 568
 Tom Nousaine 568
- Author's Reply** Les Leventhal 569

TECHNICAL COMMITTEE REPORTS

- Minutes of the Meeting of the AES Standards Subcommittee on Digital Audio** ... Robert A. Finger 573

FEATURES

- 5th International Conference Report** 582
Program 592

DEPARTMENTS

- | | | | |
|--|-----|---|-----|
| News of the Sections | 604 | In Memoriam | 620 |
| Upcoming Meetings | 608 | AES Annual Report | 622 |
| Sound Track | 608 | Call for Papers—84th Convention,
Paris, 1988 | 623 |
| Abstracts of Interest | 610 | Information for Authors of Convention
Papers | 625 |
| New Products and Developments | 611 | AES Conventions and Conferences | 626 |
| Available Literature | 613 | | |
| Membership Information | 615 | | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 35 NUMBER 9

1987 SEPTEMBER

CONTENTS

PAPERS

- Problems with Shadowless Stereo Theory: Asymptotic Spectral Status** Duane H. Cooper 629
Loudspeaker reproduction of spectrally unmodified stereo microphone signals is audibly unsatisfactory for frequencies above a few hundred hertz. Satisfactory system development is suggested by comparing the findings of J. L. Bauck with other research.

- Complex Simulation of Acoustical Sound Fields by the Delta Stereophony System (DSS)** Wolfgang Ahnert 643
Separated loudspeakers fed with staggered-delay signals provide reinforced sound in several large installations.

COMMUNICATIONS

- The U.K. System for Digital Stereo Sound with Terrestrial Television** S. R. Ely 653
A third carrier, phase-shift keyed at 728 kilobits per second, accommodates two digital sound channels. Laboratory and broadcast tests prove the system ruggedness and compatibility.

- Multichannel Television Sound Broadcasting in the United States** Randy Hoffner 660
Stereophonic audio and two additional subcarrier signals emerge from the system whose history and specifications are given here.

LETTERS TO THE EDITOR

- Comments on "A Psychoacoustically Optimized Loudspeaker"** Malcolm J. Hawksford and Richard Bews 666
Author's Reply Kenneth L. Kantor 667
Further Corrections on "Design of Optimized Loudspeaker Crossover Networks Using a Personal Computer" Peter L. Schuck 667

STANDARDS

- Standards News from JASA** (Reprint, JASA, Vol. 81(5), pp. 1646-1650, 1987 May) 669

MESSAGE TO MEMBERS

- Special Election Results** 674

FEATURES

- 83rd AES Convention Preview** 676
Exhibit Previews 678
Exhibitors 718

DEPARTMENTS

- | | | | |
|-----------------------------------|-----|--|-----|
| News of the Sections | 722 | Membership Information | 731 |
| Upcoming Meetings | 728 | In Memoriam | 741 |
| Sound Track | 728 | Membership Application Form | 742 |
| Available Literature | 730 | AES Conventions and Conferences | 746 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 35 NUMBER 10

1987 OCTOBER

CONTENTS

PAPERS

Three-Dimensional Image Reconstruction in Audio Anthony Romano 749
Sound sources, sufficient in number and suitably placed within a given enclosure, can reproduce a specified sound field. The theory is developed for such reconstruction.

Soft Magnetic Materials for Audio Transformers: History, Production, and Applications G. A. V. Sowter 760
Almost every conceivable audio system now depends on magnetic iron. This history summarizes its development.

Heat-Transfer Mechanisms in Loudspeakers: Analysis, Measurement, and Design Clifford A. Henricksen 778
Temperature rise in a high-power loudspeaker is predicted by analysis of the voice coil's thermal interaction with air, magnet, and loudspeaker frame.

ENGINEERING REPORTS

Electroacoustic System Realizations for the Linkwitz-Riley Crossover Networks W. Marshall Leach, Jr. 792
An active crossover network must include the transfer functions of the higher frequency drivers to produce an overall Linkwitz-Riley response. A simpler network gives approximately similar results.

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 82(1), pp. 394-399, 1987 July) 801

MESSAGE TO MEMBERS

AES Education Awards 810

FEATURES

2nd Regional Convention Report 812
 Program 820
Review of Society's Sustaining Members 832

DEPARTMENTS

Review of Acoustical Patents	807	Available Literature	857
News of the Sections	851	Membership Information	859
Upcoming Meetings	854	In Memoriam	862
Sound Track	855	Membership Application Form	863
New Products and Developments	856	AES Conventions and Conferences	866

CONTENTS

PAPERS

How to Measure and Interpret Coherence Loss in Magnetic Recording U. Totzek and D. Preis 869
Tape recorder frequency response, distortion, noise, and modulation products are measured by comparing input and output spectra.

Loudspeaker Systems with Optimized Wide-Listening-Area Imaging Mark F. Davis 888
A loudspeaker design method controls directivity to preserve the stereophonic image within a broad listening area.

The Acoustical Design of a 4000-Seat Church A. H. Marshall, C. W. Day, and L. J. Elliott 897
Design of this church auditorium required specification of room acoustics, sound reinforcement, building noise, and isolation from the outside environment.

ENGINEERING REPORTS

Ultra-Low-Noise Amplifiers and Granularity Distortion D. R. G. Self 907
Experiments with a low-noise amplifier reveal none of the microscopic nonlinearities sometimes proposed to explain subjective preference for particular circuit components.

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 82(3), pp. 1095-1099, 1987 September) 916

FEATURES

Choosing the Right Microphone by Understanding Design Tradeoffs Bruce Bartlett 924

DEPARTMENTS

Data Request for AES Directory of Educational Programs	921	Membership Information	953
News of the Sections	945	Call for Papers—3rd Regional Convention, Melbourne, 1988	956
Upcoming Meetings	948	Information for Authors of Convention Papers	958
Sound Track	948	Membership Application Form	959
New Products and Developments	950	AES Conventions and Conferences	962
Available Literature	952		

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 35 NUMBER 12

1987 DECEMBER

CONTENTS

President's Message Daniel Gravereaux 965

PAPERS

Dither in Digital Audio John Vanderkooy and Stanley P. Lipshitz 966
Low-level random noise, added to the audio signal, linearizes digital sampling and improves resolution to less than a sample step. Results are given for different noise spectra.

Horn Layout Simplified Bob Thurmond 976
High-frequency horn positioning is made easier by using linear, equal-level response contours scaled to the auditorium drawings.

A New Principle for a High-Efficiency Power Audio Amplifier for Use with a Digital Preamplifier Jørgen Arendt Jensen 984
Digital audio directly regulates the power supply for a class-B amplifier in anticipation of the amplifier's analog audio input.

ENGINEERING REPORTS

A New Principle for an All-Digital Preamplifier and Equalizer Jørgen Arendt Jensen 994
Gain and equalization are adjusted by a preamplifier operating on the digital signal for a Compact Disc.

COMMUNICATIONS

Wigner Distribution Analysis of Filters with Perceptible Phase Distortion D. Preis, F. Hlawatsch, P. J. Bloom, and J. A. Deer 1004
The time-frequency behavior of anti-aliasing filters is computed using the Wigner distribution. Analytical results are keyed to audible differences.

LETTERS TO THE EDITOR

Comments on "Spaciousness and Localization in Listening Rooms and Their Effects on the Recording Technique" Stanley P. Lipshitz 1013
Author's Reply David Griesinger 1013
Reply to Comments Michael Gerzon 1013

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 82(5), pp. 1848-1852, 1987 November) 1015

TECHNICAL COMMITTEE REPORTS

Minutes of the Meeting of the AES Digital Audio Technical Committee (1987 March 10) Bart N. Locanthi 1020

FEATURES

83rd Convention Report 1028
 Exhibitors 1044
 Program 1048
New AES Officers 1987-1988 1067
1988 AES International Sections Directory 1072

DEPARTMENTS

Upcoming Meetings 1080 **Available Literature** 1085
News of the Sections 1080 **Membership Information** 1087
Sound Track 1082 **Call for Papers— 3rd Regional Convention, Melbourne, 1988** 1090
Abstracts of Interest 1083 **Index to Volume 35** 1092
New Products and Developments 1084 **AES Conventions and Conferences** 1098

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 1/2

1988 JANUARY/FEBRUARY

CONTENTS

PAPERS

- A Technique for Displaying the Current and Voltage Output Capability of Amplifiers and Relating This to the Demands of Loudspeakers** Peter J. Baxandall 3
A test method reveals a power amplifier's sometimes idiosyncratic current-overload behavior, important when operating with a complex load. Test results are compared with those obtained using music signals and a loudspeaker.

ENGINEERING REPORTS

- Noise-Dependent Sound Reproduction in a Car: Application of a Digital Audio Signal Processor** ... W. J. W. Kitzen, J. W. Kemna, W. F. Druyvesteyn, C. L. C. M. Knibbeler, and A. T. A. M. van de Voort 18
Road noise and mechanical noise spoil the reproduction of speech and music in an automobile. Automatic compression and control of signal volume can counteract such interference unobtrusively.
- Graceful Degradation of Digital Audio Transmission Systems** K. A. Schouhamer Immink 27
Conventional digital systems fail catastrophically if the transmission bandwidth is reduced below a design threshold. A new coding method accommodates bandwidth reduction (or expansion) with corresponding adjustment in signal resolution.

COMMUNICATIONS

- Forensic Audio and Video—Theory and Applications** Tom Owen 34
Audio and video tapes entered as legal evidence are often examined for authenticity or processed to clarify their content. Analysis may identify a tape's machine-origin and disclose whether or not it has been altered.

FEATURES

- 6th AES International Conference: Sound Reinforcement** 45
- 84th AES Convention Preview** 50
- Exhibit Previews** 54
- Exhibitors** 93

DEPARTMENTS

- | | | | |
|---|----|---|-----|
| Review of Acoustical Patents | 42 | Call for Papers—3rd Regional Convention, Melbourne, 1988 | 105 |
| News of the Sections | 95 | Call for Papers—85th Convention, Los Angeles, 1988 | 107 |
| Upcoming Meetings | 96 | Information for Authors of Convention Papers | 109 |
| Sound Track | 96 | | |
| Available Literature | 98 | | |
| Membership Information | 99 | | |
| | | AES Special Publications | 110 |
| | | AES Conventions and Conferences | 112 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 3

1988 MARCH

CONTENTS

PAPERS

- Simulation of Loudspeaker Crossover Filters with a Digital Signal Processor** R. M. Aarts and A. J. M. Kaizer 115

The winner among competing crossover filters having nearly the same frequency response can be judged only by listening. Aural comparisons are fast and accurate when the analog filters are simulated by a digital processor.

- The Modification of Timbre by Resonances: Perception and Measurement** Floyd E. Toole and Sean E. Olive 122

Perceived resonant coloration, produced either by the electronic hardware or the acoustic environment, depends upon program material, hearing acuity, the resonance frequency, Q, and amplitude, and upon influences such as reverberation and delay.

- A Bayesian Analysis of A-B Listening Tests** Mark Srednicki 143

Seemingly chance results do not rule out an audible difference between A and B if the test is shorter than several hundred trials.

ENGINEERING REPORTS

- Reduction of Peak/rms Ratio of Speech by Amplitude Compression and Quadratic Phase Dispersion** John T. Lynch 147

Intentional phase dispersion of the speech signal permits amplitude compression greater than is ordinarily achieved. Preliminary results may be useful in AM (especially shortwave) broadcasting.

STANDARDS

- Minutes of the Meeting of the AES Digital Audio Standards Committee (1987 October 16)** Bart N. Locanthi 153

FEATURES

- AES 6th International Conference: Sound Reinforcement—Preliminary Program** 164
1888–1988: A Hundred Years of Magnetic Sound Recording Friedrich Karl Engel 170

DEPARTMENTS

- | | | | |
|--|-----|---|-----|
| Review of Acoustical Patents | 159 | Available Literature | 191 |
| News of the Sections | 180 | Membership Information | 194 |
| Sound Track | 185 | Call for Papers—AES 85th Convention, Los Angeles, 1988 | 196 |
| Upcoming Meetings | 188 | AES Special Publications | 198 |
| New Products and Developments | 189 | AES Conventions and Conferences | 200 |

CONTENTS

PAPERS

- Wigner Representation of Loudspeaker Responses in a Living Room**
 D. J. Verschuur, A. J. M. Kaizer, W. F. Druyvesteyn, and D. de Vries 203
Several related distributions are compared with the Wigner distribution as evaluations of loudspeaker response in a reflective room.
- Reduction of Transistor Slope Impedance Dependent Distortion in Large-Signal Amplifiers**
 Malcolm Hawksford 213
Frequency-dependent nonlinear distortion, not easily reduced by negative feedback, is generated by signal-modulated transistor impedances. Circuits are developed to minimize their influence.
- Environmental Effects on the Speed of Sound** Dennis A. Bohn 223
Variations in temperature and humidity may change room equalization abruptly, affecting both relative frequency response and high-frequency sound pressure levels.

COMMUNICATIONS

- Increasing the Life of Your Audio Tape** Jim Wheeler 232
The longevity of tape records depends on magnetic formulation, storage temperature and humidity, and exercise. Here is advice on preserving recorded signals.

STANDARDS

- Standards News from JASA (Reprint JASA, Vol. 83(1), pp. 389-395, 1988 January)** 237

FEATURES

- The Compact Disc Formats: Technology and Applications** Ken C. Pohlmann 250

DEPARTMENTS

- | | | | |
|--|-----|---|-----|
| Review of Acoustical Patents | 244 | Membership Information | 298 |
| News of the Sections | 288 | Audio Engineering Society Bylaws | 304 |
| Upcoming Meetings | 290 | Call for Papers—AES 85th Convention, Los Angeles, 1988 | 308 |
| Sound Track | 290 | AES Special Publications | 310 |
| New Products and Developments | 292 | AES Conventions and Conferences | 312 |
| Available Literature | 295 | | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 5

1988 MAY

CONTENTS

PAPERS

The Analytic Impulse Andrew Duncan 315
Mathematical analysis of real data may yield unreal results (events that precede causes, for instance), and the properties of much otherwise useful mathematics make such disappointments inevitable. If the data are judiciously windowed, the results can be interpreted more easily. Impulse responses of a loudspeaker are shown as examples.

A New Windowing Technique for Digital Harmonic-Distortion Measurement Robert W. Adams 328
Measuring an 18-bit A/D converter for harmonic distortion below -100 dB becomes possible using a digital-windowing procedure. Choice of input frequency is unconstrained. Results are confirmed for harmonics greater than -90 dB by comparison with an analog method.

Cluster Suitability Predictions Simplified Bob Thurmond 337
A single loudspeaker cluster may or may not provide acceptable speech intelligibility in a room, but acceptability is predictable. Room volume, reverberation time, loudspeaker directivity, and maximum listener distance are the governing quantities. Suggested first choice for a fix of poor results is increased room absorption.

The Use of TV Holography (ESPI) for Loudspeaker Chassis and Cabinet Modal Analysis
..... John R. Tyrer 342
Micrometer displacements of transducers or their enclosures are observed and measured using laser speckle interferometry, which exploits the interference between object illumination and a reference wave. This optical combination is linked with a video camera. Procedures are described for both continuous and pulsed laser sources.

ENGINEERING REPORTS

Sampling-Frequency Synchronization with Minimal Delay N. H. C. Gilchrist 350
Digital signals from independent sources must be synchronized before they can be digitally mixed. Temporary storage allows all samples to be accessed by a single clock, but some samples may have to be repeated, discarded, or appreciably delayed in the process. The audibility of these sacrifices is appraised.

STANDARDS

Standards News from JASA (Reprint JASA, Vol. 83(3), pp. 1203-1205, 1988 March)..... 359

FEATURES

84th Convention Report 362
 Exhibitors 375
 Program 378
Magnetic Sound Recording in Europe Up to 1945 Heinz H. K. Thiele 396

DEPARTMENTS

News of the Sections 409	Membership Information 421
Sound Track 413	In Memoriam 433
Upcoming Meetings 414	Membership Application Form 435
New Products and Developments 416	AES Special Publications 438
Available Literature 418	AES Conventions and Conferences 440

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 6

1988 JUNE

CONTENTS

PAPERS

Subwoofer Performance for Accurate Reproduction of Music

Louis D. Fielder and Eric M. Benjamin 443

Records with audible content below 30 Hz are rare, but some Compact Discs require a response beginning at 10 to 12 Hz for faithful reproduction at 110- to 120-dB sound pressure level. A suitable subwoofer, with low cutoff in the 10-Hz range, must be reasonably free of harmonic distortion and noise, particularly above 2 kHz. Room gain partly eases loudspeaker requirements, though the room itself may respond with rattles and buzz. Currently available subwoofers in a test sample were not satisfactory.

Linearly Swept Frequency Measurements, Time-Delay Spectrometry, and the Wigner Distribution

Mark A. Poletti 457

Measurements using linear sweep frequency inputs are defined in terms of the Wigner distribution. The usual time-delay spectrometry procedure is incomplete; an additional operation yields an improved transfer-function estimate while ignoring the limitation on sweep rate. Energy-time and energy-time-frequency measurements are reexamined.

ENGINEERING REPORTS

An 18-Bit Digital-to-Analog Converter for High-Performance Digital Audio Applications

Joel M. Halbert and Mark A. Shill 469

Signal processing with more than 16 bits is needed to realize the full potential of a 16-bit product. Design of this 18-bit converter is based on careful choices of binary weighting, thermal design, and noise-source evasion.

A Dynamic Phase Meter for Program Material

John Monforte 481

An aid to the broadcast engineer is this program meter's indication of stereo signal coherence. Stereo X and Y signals are first matrixed to their M-S counterparts, and the resulting vu-meter deflection is proportional to the ratio $|S/M|$.

Measuring Equipment for the Estimation of "Pop" Sensitivity of Microphones

W. Wienhöfer and J. Sennheiser 487

An acoustic pop generator produces reproducible transients for testing microphone susceptibility to this type of noise. Experimental results are shown for a microphone with and without its protective basket.

FEATURES

Digital Audio Recorders

John Watkinson 492

DEPARTMENTS

News of the Sections	510	Abstracts of Interest	521
Upcoming Meetings	516	Membership Information	522
Sound Track	516	In Memoriam	529
New Products and Developments	517	Membership Application Form	531
Available Literature	520	AES Special Publications	534
AES Conventions and Conferences		536	

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 7/8

1988 JULY/AUGUST

CONTENTS

PAPERS

Calculation of the Sound Radiation of a Nonrigid Loudspeaker Diaphragm Using the Finite-Element Method Arie J. M. Kaizer and Ad Leeuwestein 539
The finite-element method is applied to calculating the motion of a loudspeaker diaphragm and its resulting sound radiation. Examples use an ideal, rigid cone and a real, 4-inch diameter loudspeaker.

Loudspeaker Power Amplifiers with Load-Adaptive Source Impedance David Birt 552
Additional amplifier components maintain the amplifier-loudspeaker low-frequency loop resistance constant, thereby canceling changes in sensitivity and frequency response provoked by voice-coil temperature rise.

ENGINEERING REPORTS

The Design of a Digital Signal Peak Limiter for Audio Signal Processing Dan Mapes-Riordan and W. Marshall Leach, Jr. 562
Digital processing permits adjustment of signal gain in advance of an otherwise excessive signal amplitude. Gain changes occur only at signal zero-crossings and are therefore usually inaudible and relatively distortionless.

Improvement in Dome Loudspeaker Characteristics by Using a Spherical-Wave-Front Horn Baffle Junichi Hayakawa, Shiro Iwakura, Kaoru Yamazaki, and Susumu Matsuoka 575
A baffle shaped to accommodate a spherical wave front improves efficiency and reduces reflective and diffractive interference. Experimental results are shown using a 26-mm dome driver.

LETTERS TO THE EDITOR

Comments on "Choosing the Right Microphone by Understanding Design Tradeoffs" James B. Lee 585
Author's Reply Bruce Bartlett 585

STANDARDS

Standards News from JASA (Reprint JASA, Vol. 83(5), pp. 1984-1985, 1988 May) 586

FEATURES

AES 6th International Conference Report 588
Program 598
Magnetic Tape—From the Early Days to the Present Friedrich Karl Engel 606
AES 85th Convention, Los Angeles, Announcement 626

DEPARTMENTS

News of the Sections 617	AES Annual Report 634
Sound Track 621	Call for Papers—86th Convention, Hamburg, 1989 635
Upcoming Meetings 622	Information for Authors of Convention Papers 637
New Products and Developments 623	AES Special Publications 638
Available Literature 625	AES Conventions and Conferences 640
Membership Information 628	
In Memoriam 633	

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 9

1988 SEPTEMBER

CONTENTS

PAPERS

Proposed Technique for Earphone Calibration ... J. S. Russotti, T. P. Santoro, and G. B. Haskell 643
Earphone response is measured using a modified Zwislocki coupler mounted in a dummy head. With proper correction, the results can be compared with the head's equivalent field response. The method is useful for nearly all types of headphones.

Simulation and Optimization of Multiway Loudspeaker Systems Using a Personal Computer Witold Waldman 651
A computer program simulates the acoustic sum of driver outputs in a two-way or three-way system. The optimization process is flexible, allowing substitution of drivers, crossover frequencies, and driver positions.

The Subjective Effect and Measurement of ADC-DAC Transfer Characteristic Discontinuity N. H. C. Gilchrist 664
Experiments with a 14-bit converter disclose (depending on program material) the detectability of a single quantum discontinuity located at the center of the transfer characteristic. Larger discontinuities, farther removed from the center, may escape notice.

A Method of Generating and Controlling Musical Asymmetrical Spectra J.-P. Palamin, P. Palamin, and A. Ronveaux 671
Synthesized tones with adjustable formants are generated by systematically altering the individual component amplitudes in a frequency-modulated signal.

ENGINEERING REPORTS

Results of the 1986 AES Audiometric Survey Charles Martinez and Samuel Gilman 686
Tests of AES members show a small hearing deficiency added to the normal loss attributed to aging. Wide individual variations in hearing threshold are found in the range from 3 to 6 kHz.

STANDARDS

Standards News from JASA (Reprint JASA, Vol. 84(1), pp. 453-456, 1988 July) 693
AES Standards News: New Working Groups Approved 696

FEATURES

AES 2nd Regional Convention Preprint List 692
AES 85th Convention Preview 698
 Exhibit Previews 702
 Exhibitors 735

MESSAGE TO MEMBERS

AES Educational Foundation Selects Recipients 747

DEPARTMENTS

News of the Sections	737	Membership Information	748
Upcoming Meetings	740	Membership Application Form	755
Sound Track	741	AES Special Publications	758
Available Literature	744	AES Conventions and Conferences	760

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 10

1988 OCTOBER

CONTENTS

PAPERS

Acoustic Load and Transfer Functions in Rooms at Low Frequencies Tomas Salava 763
At low frequency, room dimensions and loudspeaker position peculiarly modify the loudspeaker's response. Acoustic load and transfer impedances are useful measures of overall performance, especially in small rooms.

Compact Ribbon Tweeter/Midrange Loudspeaker J. A. M. Nieuwendijk 776
Response embracing midrange to ultrasonic frequencies is achieved by combining a ribbon membrane with an air-volume spring. Sensitivity of a model loudspeaker is 94 dB SPL at one meter and one watt.

ENGINEERING REPORTS

A Loudspeaker Motor Structure for Very High Power Handling and High Linear Excursion Douglas J. Button 788
An optimized design for a woofer motor reduces nonlinear excursion and thermal power compression at levels greater than 100 watts. Choosing an aluminum voice coil instead of copper provides a significant advantage.

Audio for the Elderly Edward W. Herold 798
With increasing age, hearing deteriorates, markedly above 500 Hz. To benefit older listeners, consumer and sound reinforcement electronics might well include capabilities for high-frequency boost and amplitude compression.

FEATURES

On Improvements of Magnetic Tape Shown by Measurements on Early and Newer Tapes Rudolph Müller 802
Review of Society's Sustaining Members 822

DEPARTMENTS

News of the Sections	837	Available Literature	841
Upcoming Meetings	838	Membership Information	843
Sound Track	839	AES Special Publications	846
New Products and Developments	840	AES Conventions and Conferences	848

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 11

1988 NOVEMBER

CONTENTS

PAPERS

The Implementation of Recursive Digital Filters for High-Fidelity Audio Jon Dattorro 851
While the theoretical design of a digital filter may be routine, the hardware choices for its realization contain certain pitfalls. The author shows where the pitfalls are and how to avoid them.

Approximation Formulas for Error Risk and Sample Size in ABX Testing Herman Burstein 879
Blind testing of listener perception involves calculable risks of coming to the wrong conclusion. Leventhal's tabular results are extended with formulas for general values of sample size and response probability.

ENGINEERING REPORTS

Enhancement of Forensic Audio Recordings Bruce E. Koenig 884
Recordings useful as legal evidence are often made in miserable circumstances. Using laboratory techniques, the FBI improves the intelligibility of such recordings for presentation in a court of law. Selection and responsibilities of FBI personnel are outlined.

Effect of DAC Deglitching on Frequency Response Robert Bristow-Johnson 895
Switching noise in the digital-to-analog converter must be suppressed for high-quality audio, but the usual means for suppression degrades frequency response. The response defect can be compensated in the program material.

FEATURES

AES 3rd Regional Convention Report 906
Exhibitors 912
Program 914
Boston Symphony Hall: An Acoustician's Tour Leo L. Beranek 918

DEPARTMENTS

Review of Acoustical Patents 904 **New Products and Developments** 935
News of the Sections 932 **Available Literature** 937
Upcoming Meetings 932 **Membership Information** 939
Sound Track 934 **AES Special Publications** 942

AES Conventions and Conferences 944

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 36 NUMBER 12

1988 DECEMBER

CONTENTS

President's Message Stanley P. Lipshitz 947

PAPERS

General Equivalent Electric Circuits for Acoustic Horns J. Kergomard 948
Equivalent circuits, composed of lumped elements, represent the acoustic input impedances and transfer functions of tubes and horns. Results are applied to design of a saxophone mouthpiece.

Improvements in FMX Technology Emil L. Torick and Aldo G. Cugnini 956
Design parameters are detailed for this FM broadcast system. An additional companded stereo-difference signal yields perceived noise levels that are close to those of conventional monophonic reception. Effective service area is increased.

ENGINEERING REPORTS

High Frequency Phase Response Specifications—Useful or Misleading? Deane Jensen 968
Constant group delay (or linear phase) is crucial for waveform fidelity in electronic components, and the deviations from linear phase or constant delay (as functions of frequency) are clear assessments of quality. Phase measurements at only one or two frequencies convey no useful information.

A Holographic Approach to Acoustic Control A. J. Berkhout 977
In principle, an electroacoustically reconstructed sound field can be indistinguishable from the original. A practical system, based on holographic reconstruction, generates a field with as small an error as desired. The author finds it the ultimate method for sound reproduction or reinforcement.

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 84(3), pp. 1123–1125, 1988 September) 996

FEATURES

85th Convention Report 1002

Exhibitors 1018

Program 1021

New AES Officers 1988–1989 1036

1989 AES International Sections Directory 1039

DEPARTMENTS

Review of Acoustical Patents 999 **Membership Information** 1060

News of the Sections 1048 **In Memoriam** 1061

Upcoming Meetings 1050 **Call for Papers—AES 4th Regional**

Sound Track 1051 **Convention, Tokyo, 1989** 1062

Abstracts of Interest 1053 **Index to Volume 36** 1064

New Products and Developments 1054 **AES Special Publications** 1070

Available Literature 1057 **AES Conventions and Conferences** 1072

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 1/2 CONTENTS 1989 JANUARY/FEBRUARY

PAPERS

Prospects for Transaural Recording Duane H. Cooper and Jerald L. Bauck 3
Conventional stereophonic reproduction is spoiled by the left ear's perception of the right-hand loudspeaker and vice versa. This wrong-destination crosstalk can be canceled by adding appropriate inverse signals to the loudspeaker feeds, a correction examined often in the prior art. More nearly optimum synthesis and equalization, combined with a modified binaural recording procedure, markedly improve past results.

Equalization and Spatial Equalization of Dummy-Head Recordings for Loudspeaker Reproduction David Griesinger 20
Recordings made with dummy-head and Soundfield microphones are compared in both loudspeaker and headphone playback. Equalized dummy-head recordings are spatially more realistic than the Soundfield recordings but are sometimes less natural in reproducing individual voices.

Reproduction of Artificial-Head Recordings through Loudspeakers Henrik Møller 30
Dummy-head binaural signals are processed to cancel the interaural crosstalk that ordinarily occurs when such signals are reproduced with loudspeakers. With cancellation, loudspeaker reproduction proves generally more satisfactory than that achieved with headphones.

ENGINEERING REPORTS

Processing Artificial-Head Recordings H. W. Gierlich and K. Genuit 34
With appropriate signal processing, multiple sources can be mixed to synthesize or enhance a dummy-head recording. Shown here is the design of a console for doing so.

Theory and Design of a Digital Audio Signal Processor for Home Use David Griesinger 40
Software programming adapts this processor to work with configurations of from two to eight loudspeakers. Lateral signals are vital in the perception of concert-hall spaciousness. Their effects can be simulated by the conventional stereo loudspeaker pair using interaural cancellation, or they can be produced more directly with loudspeakers placed at the sides and rear.

LETTERS TO THE EDITOR

Comments on "Environmental Effects on the Speed of Sound" Thomas G. Bouliane 51
Author's Reply Dennis A. Bohn 52

CORRECTIONS

Correction to "Compact Ribbon Tweeter/Midrange Loudspeaker" 53

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 84(5), pp. 1954-1955, 1988 November) 56

TECHNICAL COMMITTEE REPORTS

Report of the Meetings of the Technical Council and the Technical Committees on Acoustics and Sound Reinforcement, Signal Processing, Transducers, and Transmission 58

FEATURES

AES 7th International Conference: Audio in Digital Times 64
Technical Support Functions of the AES 65
AES 86th Convention Preview 66
 Exhibit Previews 68
 Exhibitors 91

DEPARTMENTS

Review of Acoustical Patents 54 **Available Literature** 96
News of the Sections 93 **Membership Information** 97
Upcoming Meetings 94 **In Memoriam** 101
Sound Track 95 **AES Special Publications** 102
 AES Conventions and Conferences 104

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 3

1989 MARCH

CONTENTS

PAPERS

Sound Radiation from Circular Stretched Membranes in Free Space J. H. Steng 107
A stretched membrane obviously differs from a rigid piston, and the two can be expected to behave very differently as sound radiators. The circular membrane is analyzed with an exact mathematical model. Results are compared with the experimental response of an electrostatic loudspeaker.

A Model of Loudspeaker Driver Impedance Incorporating Eddy Currents in the Pole Structure John Vanderkooy 119
A loudspeaker voice coil (with its magnetic iron) is not the equivalent of a simple lossy inductor. Impedance measurements and eddy-current theory reveal an equivalent "semi-inductor," with novel consequences for loudspeaker-motor efficiency and heat dissipation.

Distortion Reduction in Moving-Coil Loudspeaker Systems Using Current-Drive Technology P. G. L. Mills and M. O. J. Hawksford 129
Several sources of nonlinear distortion, active when the loudspeaker is driven by a voltage generator, disappear if the driver is a current generator instead. The usually unsatisfactory frequency response resulting from current drive can be corrected with low-level equalization or with motional feedback.

ENGINEERING REPORTS

Analysis and Detection of Acoustically Coupled DTMF Signals James H. Hahn 149
Acoustic dual-tone signals, fed to the telephone network, may be received incorrectly by currently installed digital frequency detectors. For each tone, an optimum number of measured zero crossings would minimize errors, making possible receivers of greater reliability.

CORRECTIONS

Correction to "The Analytic Impulse" 156

Correction to "Improvements in FMX Technology" 156

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 85(1), pp. 517-519, 1989 January) 158

FEATURES

AES 7th International Conference: Audio in Digital Times—Preliminary Program 164

Updates and Additions to the AES 1989 International Sections Directory 175

DEPARTMENTS

Review of Acoustical Patents	161	In Memoriam	191
News of the Sections	170	Call for Papers—AES 87th Convention, New York, 1989	192
Sound Track	176	Information for Authors of Convention Papers	194
Upcoming Meetings	178	Membership Application Form	195
New Products and Developments	179	AES Special Publications	198
Available Literature	182		
Membership Information	184		

AES Conventions and Conferences 200

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 4

1989 APRIL

CONTENTS

PAPERS

- Time Dependence of Loudspeaker Power Output in Small Rooms** Glyn Adams 203
A loudspeaker's output power is modified by the geometry of the space into which it radiates. In a small room, all of the room boundaries contribute to this modification, largely so at frequencies where the room is resonant. Room-loading varies with time during transient signals.
- Subjective Evaluation of Angular Displacement between Picture and Sound Directions for HDTV Sound Systems** Setsu Komiyaama 210
Conventional two-channel stereo fails to pinpoint a satisfactory coincidence of sound and picture images for high-definition television. Three, four, or five channels have been proposed as necessary, but there is not agreement on their number or disposition. A subjective experiment evaluates viewer annoyance versus angular displacement of visual and sound sources, suggesting an additional center channel as sufficient for horizontal localization.

ENGINEERING REPORTS

- New Magnetic System Designs for Sound-Reinforcement Loudspeaker Applications** Raymond J. Newman and Paul F. Fidlin 215
Loudspeaker motors using new magnetic materials can be smaller and lighter than their predecessors. A redesigned compression driver is more compact than its original and weighs one-third as much. Possibilities are examined for weight reduction in sound-reinforcement arrays.
- A Feedforward Side-Chain Limiter/Compressor/De-esser with Improved Flexibility** A. J. Oliveira 226
The controls of this dynamic limiter provide independent adjustment of compression, threshold, and soft or hard limiting, with constant before-threshold gain. Use of a feedforward side chain results in attack and release times that are independent of compression-ratio settings.

EDUCATION NEWS

- Audio Engineering Society Educational Foundation Awards Program** 241
- Richard Heyser Scholarship Loan Fund Is Tax Exempt** 241

FEATURES

- AES 4th Regional Convention: Sound Engineering Today and Tomorrow** 242
- The Spectral Amplitude Distribution of Selected Compact Discs** R. A. Greiner and Jeff Eggers 246

DEPARTMENTS

- | | | | |
|--|-----|--|-----|
| News of the Sections | 276 | Membership Information | 289 |
| Upcoming Meetings | 280 | AES Bylaws | 296 |
| Sound Track | 280 | Call for Papers—AES 87th Convention, | |
| New Products and Developments | 284 | New York, 1989 | 300 |
| Available Literature | 287 | AES Special Publications | 302 |
| | | AES Conventions and Conferences | 304 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 5

1989 MAY

CONTENTS

Editor's Message: Staff Changes in the Publications Office Robert O. Fehr 307

PAPERS

An Introduction to Band-Pass Loudspeaker Systems Earl R. Geddes 308
A driver working into enclosures fore and aft, with ports in one or both, generates a band-pass response. Crossover responsibilities can then be partly transferred from networks to reproducers, with reduced cost, improved cutoff slopes, and greater passband efficiency.

Impulse Measurement of Acoustic Impedance Josef Merhaut 343
A pulsed acoustic input is the foundation for measuring the input and transfer impedances of tubes and horns. The method is fast and uses conveniently available equipment.

Computation of Diffraction for Loudspeaker Enclosures Juha Backman 353
The general theory of diffraction guides a computation of the pressure, energy, and polar responses of a loudspeaker. Taken into account are the diffractions provoked by its enclosures, assuming that the enclosure is convex and formed (as it usually is) of surfaces that are plane and nonabsorbing.

Transformed Binomial Confidence Limits for Listening Tests Herman Burstein 363
Confidence limits are derived for the percentage of correct listening-test responses that are known (heard), differing from those responses that are merely correct guesses. Results apply to both ABX and multiple-choice testing.

STANDARDS

Standards News from JASA (Reprint JASA, Vol. 85(3), pp. 1384-1385, 1989 March) 368

FEATURES

86th Convention Report 370
 Exhibitors 384
 Program 387

DEPARTMENTS

News of the Sections 401	Membership Information 408
Sound Track 403	Call for Papers—AES 87th Convention, New York, 1989 412
Upcoming Meetings 404	AES Special Publications 414
New Products and Developments 405	AES Conventions and Conferences 416
Available Literature 407	

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 6

1989 JUNE

CONTENTS

PAPERS

- Transfer-Function Measurement with Maximum-Length Sequences**
 Douglas D. Rife and John Vanderkooy 419
Direct measures of a system's impulse response forces compromise with either system overload or noise contamination. The same response is acquired more easily using a particular repetitive binary-signal input. The method is alternative to time-delay spectrometry or to fast-Fourier-transform measurements.
- A New Method for the Design of Crossover Filters** R. M. Aarts 445
An adjustable digital filter feeds each driver of an experimental loudspeaker. Optimal choice of filter coefficients enables the loudspeaker to mimic a given response, real or imagined. Impersonations of several commercial loudspeakers are judged using both listening tests and comparative measurements.
- Application of Digital Filters to Loudspeaker Crossover Networks**
 Rhonda Wilson, Glyn Adams, and Jonathan Scott 455
We approach audio systems that "perform all necessary signal processing in the digital domain" before converting to analog signals for the loudspeakers. Crossover functions and driver equalization might as well be included, and the methodology for doing so is explored. Listeners test the audibility of two off-axis crossover notches.

ENGINEERING REPORTS

- Topological Enhancements of Translinear Two-Quadrant Gain Cells**
 Malcolm O. J. Hawksford and P. G. L. Mills 465
The authors review the shortcomings of bipolar voltage-controlled amplifiers—in particular, their increased distortion at high signal attenuation—and suggest circuits that offer improvement. Experimental noise and distortion measurements are included.
- A Stereo 16-Bit Delta-Sigma A/D Converter for Digital Audio**
 D. R. Welland, B. P. Del Signore, E. J. Swanson, T. Tanaka, K. Hamashita,
 S. Hara, and K. Takasuka 476
Theory of the delta-sigma modulator is reviewed and applied to design of a two-channel, oversampled, A/D converter with a sampling rate of 3 MHz. Measured noise spectra and S/N ratios are shown.

LETTERS TO THE EDITOR

- Comments on "The Implementation of Recursive Digital Filters of High-Fidelity Audio"**
 Louis R. Eagle 486
- Author's Reply** Jon Dattorro 486

STANDARDS

- Standard News from JASA (Reprint JASA, Vol. 85(5), pp. 2239-2240, 1989 May)** 487

FEATURES

- Jack Mullin: The Man and His Machines** Peter Hammar 490

DEPARTMENTS

- | | | | |
|--|-----|---------------------------------------|-----|
| News of the Sections | 514 | Available Literature | 528 |
| Sound Track | 520 | Membership Information | 529 |
| Upcoming Meetings | 524 | In Memoriam | 531 |
| New Products and Developments | 526 | AES Special Publications | 534 |
| AES Conventions and Conferences | | 536 | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 7/8

1989 JULY/AUGUST

CONTENTS

PAPERS

- The Detection of Reflections in Typical Rooms** Sean E. Olive and Floyd E. Toole 539
Reflective environments obviously modify the quality of reproduced sound. For small rooms and stereophonic reproduction, past research does not completely define whether various reflections are welcome or unwelcome. Experimental results extend those evaluations.
- Acoustic Waveguide Theory** Earl R. Geddes 554
Horn theory is inexact. A few horn geometries permit an exact wave description in terms of a single variable. One such geometry yields an apparently ideal constant-directivity horn.
- An Introduction to Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI) for Audio System Designers** Philip Giddings 570
Electromagnetic noise and interference are avoided by well-known techniques. The author reviews recommended practice in equipment interconnection, shielding, cabling, and grounds.
- Electroacoustic-Analogous Circuit Models for Filled Enclosures** W. Marshall Leach, Jr. 586
A loudspeaker enclosure's acoustic impedance is altered by adding filling material. Circuit analogs are developed to represent the modified box compliance and the thermodynamic and kinetic behavior of the filler.

ENGINEERING REPORTS

- A Digital Approach to Time-Delay Spectrometry** Richard Greiner, Jamsheed Wania, and Gerardo Noejovich 593
TDS measurements are usually made with analog equipment. Here the same measurement is accomplished digitally, using an IBM-AT computer and appropriate hardware, and produces energy-time results as well.

FEATURES

- An Afternoon with: John K. Hilliard** 605
- AES 7th International Conference Report** 608
- Program** 614

DEPARTMENTS

- | | |
|--|---|
| Review of Acoustical Patents 603 | Available Literature 645 |
| News of the Sections 630 | Membership Information 648 |
| Upcoming Meetings 632 | In Memoriam 652 |
| Sound Track 633 | AES Annual Report 653 |
| New Products and Developments 640 | AES Special Publications 654 |
| AES Conventions and Conferences 656 | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 9

1989 SEPTEMBER

CONTENTS

PAPERS

- Sound Intensity and Interaural Cross-Correlation Measurements Using Time-Delay Spectrometry** John Konnert, Farrel Becker, and Charles Bilello 659
Spatially orthogonal components of the early reflections in a control room are measured using time-delay spectrometry. Interaural data yield interaural cross-correlation results for the same environment.
- Complex Time-Response Using Time-Delay Spectrometry** Peter D'Antonio and John Konnert 674
Time-delay spectrometry measures the complex time response of a digital delay device, a flat panel, and a reflection phase grating. The measurement theory is reviewed and extended.
- Acoustic Alignment of Loudspeaker Drivers by a Nonsymmetrical Crossovers of Different Orders** B. Hillerich 691
Separation of driver acoustic centers is compensated by choosing low-frequency and high-frequency crossover filters of different order and, therefore, different group delay. An example is shown.
- Determination of Loudspeaker Driver Parameters Using a System Identification Technique** M. H. Knudsen, J. Grue Jensen, V. Julskjaer, and P. Rubak 700
A simultaneous measurement of driver voltage, current, and displacement provides accurate estimates of the driver parameters. The method is confirmed by experiment.
- The Differential Time-Delay Distortion and Differential Phase-Shift Distortion as Measures of Phase Linearity** W. Marshall Leach, Jr. 709
Acoustic signals can be viewed as modulated carriers. Bandlimited systems delay carrier and modulation envelope unequally. The temporal delay difference is developed as a phase distortion measure.

FEATURES

- An Afternoon with: Bill Putnam** 723
- AES 87th Convention Preview** 733
- Exhibit Previews** 736

DEPARTMENTS

- | | | | |
|--|-----|--|-----|
| Review of Acoustical Patents | 716 | Membership Information | 783 |
| News | 719 | Call for Papers—AES 88th Convention, Montreal, 1990 | 784 |
| Upcoming Meetings | 765 | Information for Authors of Convention Papers | 786 |
| News of the Sections | 766 | Membership Application Form | 787 |
| Sound Track | 770 | AES Special Publications | 790 |
| New Products and Developments | 778 | | |
| Available Literature | 780 | AES Conventions and Conferences | 792 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 10

1989 OCTOBER

CONTENTS

PAPERS

Self-Similarity and Fractals in Science and Art Manfred R. Schroeder 795
Sooner or later, the strangest of purely mathematical inventions are retrieved to illuminate our experimental perceptions. Recent advances—and their limits—in describing chaotic nonlinear systems are reviewed, and a self-similar musical example challenges our presuppositions concerning pitch.

Transconductance Power Amplifier Systems for Current-Driven Loudspeakers
 P. G. L. Mills and M. O. J. Hawksford 809
Advantages accrue in choosing to drive a loudspeaker with current that is independent of loudspeaker impedance (the dual of an independent driving voltage). The wisdom of this choice is confirmed in experiments with an amplifier especially designed for current drive.

ENGINEERING REPORTS

XY and MS Microphone Techniques in Comparison Manfred Hibbing 823
With ideal microphones, XY and MS arrangements are equivalent; each is transformable to the other. In practice, microphone imperfections get in the way. Faults accounted for, MS is more reliable and less prone to error.

Stereo Sound Recording with Shotgun Microphones Henning Gerlach 832
Under some circumstances in television or motion-picture production, interference-tube microphones can prove useful as a stereo pair. Experimental responses are given for XY and MS configurations, and choices are suggested for microphone design and placement.

LETTERS TO THE EDITOR

Comments on "Diffusing Surfaces in Concert Halls: Boon or Bane?"
 John Konnert and Peter D'Antonio 839

Author's Reply Jeffrey Borish 843

A Hilliard Reminiscence Leslie E. Gilliss 845

CORRECTIONS

Corrections to "Topological Enhancements of Translinear Two-Quadrant Gain Cells" 845

FEATURES

4th Regional Convention Report 846

Review of Society's Sustaining Members 851

DEPARTMENTS

News	848	Available Literature	888
News of the Sections	876	Membership Information	891
Upcoming Meetings	878	In Memoriam	892
Sound Track	879	AES Special Publications	894
New Products and Developments	884	AES Conventions and Conferences	896

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 11

1989 NOVEMBER

CONTENTS

PAPERS

- Multiple-Point Equalization in a Room Using Adaptive Digital Filters** S. J. Elliott and P. A. Nelson 899
Equalizing the acoustic response at one point of an environment may degrade the response at other points. A better procedure equalizes at several points together, using a mean-squares criterion to specify the equalizer. A modeled automobile interior furnishes an example.
- Loudspeaker Cabinet Edge Diffraction** James Porter and Earl Geddes 908
Analyses using the geometric theory of diffraction and the finite element method yield similar results. With axisymmetric radiators as examples, the useful wavelength ranges and advantages of the two methods are compared.

ENGINEERING REPORTS

- Adaptive Loudspeaker System** Joji Kuriyama and Yasuyuki Furukawa 919
An adaptive filter corrects the amplitude and phase responses of a loudspeaker. Experiments achieve the desired correction in seconds, using either music or white noise as the input signal.
- Broadcast-Quality Speech from Diving Helmets** D. J. Meares 927
Acquiring speech of broadcast quality from a diver presents unusual problems. Diver safety and comfort, avoiding valve and breathing noises, and determining appropriate equalizations are matters reported here.

COMMUNICATIONS

- An Improved Preemphasis Standard for AM Broadcasting** A. N. Thiele 934
Thoughtless receiver design and aggressive transmission practice have damaged the quality of AM reception. The author proposes a preemphasis-deemphasis characteristic, and the networks for its realization, to improve the received signal while minimizing adjacent-channel interference. Also discussed are optimal means for eliminating the adjacent-carrier heterodyne.

STANDARDS

- AES Request to CCIR** Robert A. Finger 940
- Standard News from JASA (Reprint JASA, Vol. 86(3), pp. 1195-1199, 1989 September)** 942

FEATURES

- Tube Manufacturing at Western Electric: The WE 300B** Attila R. Balaton 949

DEPARTMENTS

- | | | | |
|--|-----|--|-----|
| Review of Acoustical Patents | 947 | Sound Track | 964 |
| News | 948 | New Products and Developments | 967 |
| News of the Sections | 960 | Available Literature | 972 |
| Upcoming Meetings | 962 | AES Special Publications | 974 |
| AES Conventions and Conferences | | 976 | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 37 NUMBER 12

1989 DECEMBER

CONTENTS

President's Message	Benjamin Bernfeld	979
---------------------------	-------------------	-----

PAPERS

Chaos, Oversampling, and Noise Shaping in Digital-to-Analog Conversion	M. O. J. Hawksford	980
<i>"Information theory predicts that when a bandlimited signal is oversampled, the output data can tolerate a reduction in amplitude resolution yet maintain a similar in-band signal-to-noise ratio." The author demonstrates how this principle might be realized using high (x 200) oversampling and noise shaping, with reduced stress on performance of the digital-to-analog converter.</i>		

Application of Speech Intelligibility to Sound Reinforcement	Don Davis and Carolyn Davis	1002
<i>Several methods have been developed to measure speech intelligibility instrumentally as opposed to using word lists and a panel of listeners. This paper defines what is measured, compares the results with causes known to enhance or degrade intelligibility for a listener, and reports the experimental results obtained with commercial instruments in three acoustic environments.</i>		

Correlation of Speech Intelligibility Tests in Reverberant Rooms with Three Predictive Algorithms	Kenneth D. Jacob	1020
<i>Subjective intelligibility results for ten variously reverberant rooms are compared with the predictions of three algorithms based on measurements. Experimental details are given to encourage repetition by others. Of the three predictors used here, the Speech Transmission Index was the most accurate.</i>		

LETTERS TO THE EDITOR

Comments on "The Analytical Impulse"	Eugene T. Patronis, Jr.	1031
Author's Reply	Andrew Duncan	1031
Eugene T. Patronis, Jr. Reponse		1032
Andrew Duncan Response		1034

CORRECTIONS

Correction to 1989 September Journal (vol. 37, p. 658)		1034
--	--	------

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 86(5), p. 2042, 1989 November)		1035
--	--	------

FEATURES

AES 87th Convention Wrap-Up		1042
Program		1056
New AES Officers 1989-1990		1076
1990 AES International Sections Directory		1079

DEPARTMENTS

Review of Acoustical Patents	1036	In Memoriam	1105
News	1040	Call for Papers—AES 87th Convention, Los Angeles, 1990	1106
News of the Sections	1086	Information for Authors of Convention Papers	1108
Upcoming Meetings	1088	Call for Nominations	1109
Sound Track	1090	AES Special Publications	1110
New Products and Developments	1093	AES Conventions and Conferences	1112
Available Literature	1095		
Index to Volume 37	1097		

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 38 NUMBER 1/2

1990 JANUARY/FEBRUARY

CONTENTS

PAPERS

- Authentication of Forensic Audio Recordings** Bruce E. Koenig 3
Taped "fingerprints"—revealing a particular recorder's head structure, transport idiosyncrasies, start and stop transients, and speed defects—assist in identifying a tape as either original or a manipulated copy. The FBI uses these and other laboratory identifications in qualifying recorded evidence for presentation in court.

ENGINEERING REPORTS

- Thermal Parameters and Power Ratings of Loudspeakers** Carlo Zuccatti 34
Voice-coil temperature rise depends on construction specifics of the loudspeaker motor; permissible temperature depends on wire and insulation quality. A typical loudspeaker is analyzed, and formulas are given to determine allowable peak and average power, based on a hypothetical music signal.

COMMUNICATIONS

- Transaural Stereo and Near-Field Listening** Tomas Salava 40
From our current understanding of stereophonic loudspeaker reproduction and room equalization, it appears that a system using dummy-head recordings and near-field loudspeakers might best satisfy the serious listener.

STANDARDS

- Standards News from JASA (Reprint, JASA, Vol. 87(1), pp. 455–456, 1990 January)** 42
Draft AES Recommended Practice for Digital Audio Engineering—Serial Multichannel Audio Digital Interface (MADI) (insert)
Draft AES Recommended Practice for Digital Audio Engineering—Synchronization of Digital Audio Equipment in Studio Operations (insert)

FEATURES

- AES Timeline: The 80s** Stephanie Paynes 49
AES 88th Convention Preview 57
Exhibit Previews 60

DEPARTMENTS

- | | |
|--|---|
| Review of Acoustical Patents 44 | Sound Track 79 |
| News 48 | New Products and Developments 85 |
| News of the Sections 74 | Available Literature 88 |
| Upcoming Meetings 78 | Membership Information 90 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 38 NUMBER 3

CONTENTS

1990 MARCH

PAPERS

Localization of Sound in a Room with Reflecting Walls W. M. Wagenaars 99
Subjects are tested for ability to discriminate distance and direction of loudspeaker sources in a conventional, reflective living room. Noise, narrow pulses, pulsed sinusoids, and music are the test signals. Discrimination increases with signal bandwidth.

Analysis and Synthesis of Tones by Spectral Interpolation Marie-Helene Serra, Dean Rubine, and Roger Dannenberg 111
A variable instrumental tone is digitally reproduced by interpolating among time-sequential samples of its spectrum. The reproduction proves perceptually indistinguishable from the original even when the acquired spectral samples are relatively infrequent. An elaboration of the method splices the sustained tone with a chosen attack. Results are compared with those of earlier techniques.

A Method of Artificial Reverberation Quality Testing Andrzej Czyzewski 129
Subjective acceptance of early reverberation depends on both the delay time and the music characteristics. The author supposes that reverberation quality might peak at a particular value of the cross-correlation of reverberator input and output signals. Experiments prove the supposition.

ENGINEERING REPORTS

A Generalized Active Equalizer for Closed-Box Loudspeaker Systems W. Marshall Leach, Jr. 142
Provided its resonance frequency and quality factor are known, any closed-box loudspeaker can be equalized to extend its low-frequency response as part of a Butterworth fourth-order alignment. Shown here is the equalizer design for doing so. The method helps to protect the loudspeaker from infrasonic overload and can be modified for other responses of higher order.

LETTERS TO THE EDITOR

Comments on "A Model of Loudspeaker Driver Impedance Incorporating Eddy Currents in the Pole Structure" Edward F. McClain, Jr. 147
Author's Reply John Vanderkooy 147

Comments on "Impulse Measurement of Acoustic Impedance" Keith Holland, Frank Fahy, and Philip Newell 148

Comments on "The Implementation of Recursive Digital Filters for High-Fidelity Audio" Paul E. Neyrinck 149
Author's Reply Jon Dattorro 150

Comments on "The Implementation of Recursive Digital Filters for High-Fidelity Audio" Jon Dattorro 151

CORRECTIONS

Correction to "An Introduction to Band-Pass Loudspeaker Systems" Earl R. Geddes 152

FEATURES

AES 8th International Conference: The Sound of Audio—Preliminary Program 156
Fiber Optics—The New Medium for Audio: A Tutorial Ronald G. Ajemian and Albert B. Grundy 160

DEPARTMENTS

Review of Acoustical Patents	153	New Products and Developments	189
News	155	Available Literature	192
News of the Sections	176	In Memoriam	196
Upcoming Meetings	178	AES Special Publications	198
Sound Track	182	AES Conventions and Conferences	200

CONTENTS

INTRODUCTION Neil A. Shaw 203

PAPERS

Measurement and Estimation of Large Loudspeaker Array Performance
..... Mark R. Gander and John M. Eargle 204
Measurements of small arrays are useful in specifying large arrays, provided low-frequency mutual coupling and large-array distance attenuation are accounted for.

An Array Filtering Implementation of a Constant-Beam-Width Acoustic Source
..... Jefferson A. Harrell and Elmer L. Hixson 221
Controlling the spacing and frequency response of each element in an array produces a main lobe of nearly constant directivity over a wide band.

Near-Field and Far-Field Performance of Large Woofer Arrays G. L. Augspurger 231
Alternatives to the conventional, nondirectional woofer are examined by computer simulation. The near-field stack, tapered endfire array, and cardioid array are practical examples.

Multiple-Beam, Electronically Steered Line-Source Arrays for Sound-Reinforcement Applications David G. Meyer 237
An array of horizontal line sources, functionally and esthetically superior to a central cluster, is especially suitable for long, narrow, reverberant environments.

Prediction of the Full-Space Directivity Characteristics of Loudspeaker Arrays
..... Kenneth D. Jacob and Thomas K. Birkle 250
Five methods for calculating array response are compared, including the detailed responses of individual elements as opposed to assuming element simplicity. A hybrid technique appears to be generally suitable.

Large Arrays: Measured Free-Field Polar Patterns Compared to a Theoretical Model of a Curved Surface Source John Meyer and Felicity Seidel 260
The authors propose a definition of loudspeaker arrayability, depending upon whether or not given loudspeaker configurations yield polar irregularities smaller than 6 dB. Measurements illustrate the concept.

Comparative Performance of Three Types of Directional Devices Used as Concert-Sound Loudspeaker Array Elements Paul F. Fidlin and David E. Carlson 271
Experimental response patterns are measured for arrays formed of constant-directivity, radial, and collapsing-polar horns. Constant-directivity elements are consistently superior.

DEPARTMENTS

Review of Acoustical Patents	296	New Products and Developments	314
News of the Sections	298	News	322
Sound Track	306	In Memoriam	324
Upcoming Meetings	310	AES Special Publications	326
AES Conventions and Conferences		328	

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 38 NUMBER 5

1990 MAY

CONTENTS

PAPERS

- Charge Movements on the Stretched Membrane in a Circular Electrostatic Push-Pull Loudspeaker** J. H. Streng 331
Surface movement of an electrostatic diaphragm's charge produces nonlinear distortion and a frequency-dependent change in level. In practice, the distortion can easily be made negligible. Not so the level change.

- Calculation of Sound Radiation from an Unbaffled, Rectangular-Cross-Section Horn Loudspeaker Using Combined Analytical and Boundary-Element Methods** T. Shindo, T. Yoshioka, and K. Fukuyama 340
Computer calculation methods for unbaffled horn radiation are confirmed by measurements on two loudspeakers, large and small.

ENGINEERING REPORTS

- Radiation Impedance Calculations for a Rectangular Piston** G. Bank and J. R. Wright 350
Maxwell suggested a principle for specifying the pressure at each element of a piston in relation to all others. Elaboration of the idea leads to radiation impedance calculations for a rectangular piston of any aspect ratio.

- Telephone Hybrid with an Automatic Dual DSP Feedback Canceler** J. H. M. Janssen and A. M. v. Bokhorst 355
Broadcasts of telephone conversations are spoiled by incomplete cancellation in the conventional telephone hybrid and by send-receive signal mixing in the studio. The resulting voice coloration, feedback, and echo are voided with an automatic digital canceler.

- Audio Applications of Electrothermomechanical Film (ETMF)** Juha Backman 364
A thin plastic film loaded with flat bubbles of air (or liquid) can function as an electroacoustic, electrodynamic, or thermal transducer. Physical properties and possible applications are discussed.

LETTERS TO THE EDITOR

- Comments on "A Digital Approach to Time-Delay Spectrometry"** Robert Bristow-Johnson 372
Author's Reply Richard Greiner 373

STANDARDS

- Standard News from JASA (Reprint JASA, Vol. 87(3), pp. 1374-1376, 1990 March)** 374

FEATURES

- 88th Convention Program** 379
88th Convention Report 386

DEPARTMENTS

- | | |
|---|--|
| Review of Acoustical Patents 377 | New Products and Developments 406 |
| News 394 | In Memoriam 413 |
| News of the Sections 396 | AES Special Publications 414 |
| Sound Track 400 | AES Conventions and Conferences 416 |
| Upcoming Meetings 405 | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 38 NUMBER 6

1990 June

CONTENTS

PAPERS

Increasing Coverage of International Shortwave Broadcast through Improved Audio Processing Techniques.....Robert Orban 419
Several audio processing methods combine to tailor the modulating signal and increase the average modulation, avoid transmitter distortion, enhance intelligibility, and compensate shortcomings of the usual receiver.

Stereo Reproduction with Good Localization over a Wide Listening Area.....Shigeaki Aoki, Hiroyuki Miyata, and Kiyoshi Sugiyama 433
Each channel of this stereophonic system uses three loudspeakers, separately driven by direct, delayed, and inverted channel signals. Improved localization is demonstrated in a simulated teleconferencing environment.

ENGINEERING REPORTS

An IC Chip Set for 20-Bit A/D Conversion.....Robert W. Adams 440
A technique for analog-to-digital conversion based on noise shaping and digital decimation is realized in integrated circuits and achieves a dynamic range greater than 108 dB. Limiting noise sources are examined.

Measuring AES-EBU Digital Audio Interfaces.....Richard C. Cabot 459
Much equipment is not designed to AES-EBU specification. Even when it is, troubles arise from interference and signal distortion in multiple or mismatched interconnecting cables. Testing methods reveal the problem details.

Dependence of Microphone Pop Data on Loudspeaker Properties.....E. Werner 469
Several loudspeaker pop generators are developed to test microphone response to artificial plosives; recommended loudspeaker excitations are given. Measured pop rankings of the experimental microphones are consistent with subjective results.

FEATURES

8th Conference Program.....479
8th Conference Report.....482
20th Anniversary—European Conventions.....488

DEPARTMENTS

Review of Acoustical Patents477	Available Literature508
News of the Sections494	Call for Papers512
Sound Track499	AES Special Publications518
New Products and Developments503	AES Conventions and Conferences520

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 38 NUMBER 7/8

1990 JULY/AUGUST

CONTENTS

PAPERS

- Theory and Real-Time Implementation of Time-Varying Digital Audio Filters
.....J. N. Mourjopoulos, E. D. Kyriakis-Bitzaros, and C. E. Goutis 523
In-transit signals are corrupted during adjustment of a digital filter's gain or passband. The signal itself, the filter parameters, and parameter rates of change affect the audibility of such disturbances. Optimal conditions for inaudibility are proposed and tested in a microprocessor simulation.

ENGINEERING REPORTS

- The Effects of Sampling Clock Jitter on Nyquist Sampling Analog-to-Digital Converters,
and on Oversampling Delta-Sigma ADCs.....Steven Harris 537
Theory, computer simulation, and experimentally jittered clocks show no difference between Nyquist-sampling and oversampling converter sensitivity to jitter. Peak white-noise jitter must be less than 0.4 nanosecond for a dynamic-range degradation less than 0.5 dB.
- An Improved Stereo Microphone Array Using Boundary Technology: Theoretical Aspects
.....Bruce Bartlett and Michael Billingsley 543
Two omnidirectional microphone capsules, mounted in the angled planes of a baffle, provide a stereophonic microphone that avoids disadvantages of customary arrangements.
- Practical Field Recording Applications: An Improved Stereo Microphone Array
Using Boundary Technology.....Michael Billingsley and Bruce Bartlett 553
The authors summarize several years of experience in recording with a non-traditional microphone, solving difficulties "often impossible to correct" otherwise.
- On the Electroacoustic-Analogous Circuit for a Plane Wave Incident on the Diaphragm of
a Free-Field Pressure Microphone.....W. Marshall Leach, Jr. 566
An improved circuit model for a pressure microphone accounts for reflections at the diaphragm and reveals the characteristic rise in microphone response at high frequency.

FEATURES

- 89th Convention Preview572
Exhibit Previews576
An Afternoon With John G. Frayne.....597

DEPARTMENTS

- | | | | |
|-----------------------------------|-----|--------------------------------------|-----|
| Review of Acoustical Patents..... | 569 | Membership Information..... | 609 |
| News of the Sections..... | 600 | AES Special Publications..... | 614 |
| Sound Track..... | 606 | AES Conventions and Conferences..... | 616 |
| Available Literature..... | 608 | | |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 38 NUMBER 9

1990 SEPTEMBER

CONTENTS

PAPERS

The PA-422 Communications Interface and Device Control LanguageRobert L. Rodgers 619
Optimal use of professional, computer-controlled equipment (e.g., equalizers, gain controls) is hampered by lack of an able and flexible communications interface. Hardware, coding, and language for a suitable remedy are detailed here, based on EIA RS-422 specifications.

The Ear as a Mechanism of CommunicationEdith L.R. Corliss 640
The ear's bandwidth, dynamic range, and signal-to-noise ratio limit satisfactory recognition of speech in much the same way as other communication systems limit reliable information transfer. Speech recognition data assist in the diagnosis of hearing impairments.

A Phase-Linear Audio Equalizer: Design and Implementation653
.....Juan A. Henriquez, Terry E. Riemer, and Russell E. Trahan, Jr.
An eleven-band digital equalizer permits gain adjustment of each band without affecting others and is phase linear for any gain combination. Design techniques used in the development are useful for other systems.

Investigation of the Nonrigid Behavior of a Loudspeaker Diaphragm Using Modal Analysis667
.....Christopher J. Struck
Physical distortion of a loudspeaker diaphragm appears at vibration frequencies above the piston range. A loudspeaker's modal analysis is compared with experimental results obtained with a laser velocity transducer.

STANDARDS

Standards News from JASA (Reprint, JASA, Vol. 87(5), pp. 2264-2265, 1990 May).....679
Draft AES Recommended Standard for Sound-Reinforcement Systems—Communications Interface (PA-422).....(insert)
Draft AES Standard Method for Digital Audio Engineering—Measurement of Digital Audio Equipment.....(insert)

FEATURES

Digital Audio InterfaceMel Lambert 681

DEPARTMENTS

Review of Acoustical Patents676	New Products and Developments708
Forum680	Available Literature713
News of the Sections698	Membership Information715
Sound Track704	In Memoriam718
Upcoming Meetings706	AES Annual Report719

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 39 NUMBER 10

1991 OCTOBER

CONTENTS

PAPERS

- Efficient Filter Design for Loudspeaker Equalization** Richard Greenfield and Malcolm Omar Hawksford 739
Digital filters offer the opportunity to improve a loudspeaker's amplitude and phase responses simultaneously. This paper compares FIR and IIR structures for doing so, outlines a rationale for filter design, and identifies other applications for the technique.
- Measurement of Panel Reflection Using Acoustical Scale Modeling Techniques** Jose C. Ortega 752
Modeling reveals the reflective differences among plane, curved, and segmented acoustic panels. For wideband uniformity, panel dimensions must exceed the largest working wavelength. Edge diffractions may spoil the performance.
- On the Naturalness of Two-Channel Stereo Sound** Günther Theile 761
For two-channel stereophonic reproduction, the projected image is, at best, a two-dimensional image (of three-dimensional sound space) in the plane that includes the loudspeakers. This nevertheless natural result is conveniently achieved with the outputs of a sphere microphone, augmented by delayed and processed spot-microphone signals.

ENGINEERING REPORTS

- Making Recordings for Simulation Tests in the Archimedes Project** Villy Hansen and Gert Munch 768
Archimedes aims to measure the subjective effects of listening room acoustics and loudspeaker directivities. Controlled experiments need carefully defined and repeatable program material. Shown here are the program specifications and recording procedures.
- The Operational Voltage-Controlled Element: Generalizing the VCA** Douglas Frey 775
A versatile monolithic device performs as a voltage-controlled amplifier, a voltage-controlled potentiometer, or an operational amplifier in circuit configurations that require otherwise separate equivalents. Applications are suggested, with assessment of noise and distortion behavior.

CORRECTIONS

- Corrections to "Combinatorial Music Theory"** Andrew Duncan 784

STANDARDS AND INFORMATION DOCUMENTS

- AES Standards Committee News** 785

FEATURES

- Review of Society's Sustaining Members** 790

DEPARTMENTS

- | | | | |
|--|-----|--|-----|
| Review of Acoustical Patents | 786 | Available Literature | 823 |
| News of the Sections | 810 | Membership Information | 825 |
| Upcoming Meetings | 816 | In Memoriam | 827 |
| Sound Track | 817 | AES Special Publications | 829 |
| New Products and Developments | 820 | AES Conventions and Conferences | 832 |

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 39 NUMBER 11

1991 NOVEMBER

CONTENTS

President's Message Roger K. Furness 835

PAPERS

Minimally Audible Noise Shaping Stanley P. Lipshitz, John Vanderkooy, and Robert A. Wannamaker 836
The perceptibility of requantizing noise is minimized by designing the noise shaper "to approximate the inverse of the audibility curve." Relatively simple techniques provide a signal-to-noise improvement equivalent to an additional two bits; greater improvement is bought with increased complexity.

ENGINEERING REPORTS

Low-Frequency Performance of Listening Rooms for Steady-State and Transient Signals Tomas Salava 853
A loudspeaker's free-field response does not predict its particular performance in a room whose dimensions are comparable with the acoustic wavelength. Loudspeaker-room coupling is described conveniently with two impedance models, and several examples are shown. Listeners test their recognition of low-frequency response irregularities.

Challenges to the Successful Implementation of 3-D Sound Durand R. Begault 864
Creative audio producers now use filtering techniques based on the head-related transfer function, but these techniques are only partial answers to problems in 3-D listener localization. A satisfactory 3-D system awaits future psychoacoustic research.

A Monolithic Dual Switch for Professional Audio Applications Derek F. Bowers 871
A dual integrated-circuit switch, each section structured as a T of junction FETs, achieves 120 dB of OFF attenuation, very low ON distortion, low crosstalk, and negligible control-signal feedthrough.

COMMUNICATIONS

Corrigendum: To the Gap Loss Formula, the Asymptotic Expansion (Eq. 15a) of Westmijze's "Studies on Magnetic Recording" [1] John G. (Jay) McKnight 878
A correction and the explanation of it are given for Westmijze's formula specifying gap loss in magnetic tape reproduction.

FEATURES

5th Regional Convention Report, Tokyo 882
 6th Regional Convention Report, Melbourne, Australia 886
 10th International Conference Report, London 892
 New AES Officers 1991/1992 898
 11th International Conference, Portland, Oregon, Call for Papers 918

DEPARTMENTS

Review of Acoustical Patents 879	Available Literature 914
News of the Sections 904	Upcoming Meetings 916
Sound Track 909	Membership Information 917
New Products and Developments 912	AES Conventions and Conferences 920

AES JOURNAL OF THE AUDIO ENGINEERING SOCIETY AUDIO/ACOUSTICS/APPLICATIONS

VOLUME 39 NUMBER 12

1991 DECEMBER

CONTENTS

PAPERS

A Simple Theory of Cabinet Edge Diffraction John Vanderkooy 923
Cabinet edge diffraction is shown to be stronger than had been predicted by earlier theory and strongly dependent on observation angle. Its computer analysis is fast and efficient. Model results are compared with those of others.

A Method for Envelope Warping in Digital Audio Synthesis Robert C. Maher 934
Nonlinear table-lookup rates permit stored sections of musical envelopes to be stretched, or contracted, without injecting timbral discontinuities. Computer simulation demonstrates the technique.

Acoustic Wave Action Inside Rectangular Loudspeaker Cabinets Jeong-Guon Ih 945
Low-frequency driver-enclosure interaction is analyzed for a non-absorbent, rectangular box with drivers or vents at various locations on the box surface. Mass loading varies substantially with driver position.

ENGINEERING REPORTS

Reliable Detection of Acoustically Coupled DTMF Signals James H. Hahn 956
Decoding of dual-tone multifrequency (DTMF) signals is unreliable when the signals are coupled acoustically to the telephone transmitter. Analog processing at the tone receiver reduces error that would otherwise arise from unavoidable distortion.

STANDARDS AND INFORMATION DOCUMENTS

AES standard method for digital audio engineering—Measurement of digital audio equipment 961
AES Standards Committee News 976

FEATURES

91st Convention Report 978
Exhibitors 988
Program 992
1991/1992 AES International Sections Directory 1018
Call for Awards Nominations 1040
Index to Volume 39 1048

ARTICLES

The Ethics of Preservation, Restoration, and Re-Issues of Historical Sound Recordings Dietrich Schüller 1014
Technical or artistic alteration of original recordings, whether for purposes of preservation or re-issue, must be carefully and openly documented in all of its details.

DEPARTMENTS

News of the Sections 1032	New Products and Developments 1042
Upcoming Meetings 1038	Membership Information 1045
Sound Track 1039	In Memoriam 1047
Available Literature 1041	AES Conventions and Conferences 1056