

**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. Henriksen 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**

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

**Review Board**

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

**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**

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

**Review Board**

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

**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**

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

**Review Board**

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

**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**

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

**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**

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

**Review Board**

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

**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 **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 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**

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

**Review Board**

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

**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 are available 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**

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

**Review Board**

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



**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**

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

**Review Board**

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

**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**

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

**Review Board**

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

**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**

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

**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**

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

**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  
**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. 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  
 G. Franklin Montgomery Consulting Technical Editor  
 Abbie J. Cohen Senior Editor  
 Michael J. Ricca Production 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. 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 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. Moris 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**

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

**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      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 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 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. 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  
**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. 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  
**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. 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 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. Locanathi 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	R. C. Heyser	S. P. Lipshitz	D. Queen
B. Blesser	W. J. J. Hoge	B. Locanathi	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. Poion	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 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. 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

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

VOLUME 34 NUMBER 3

1986 MARCH

## 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

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

## 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

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

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

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

- |  |  |
|--|--|
| <b>News of the Sections</b> ..... 592          | <b>Membership Information</b> ..... 601                        |
| <b>Upcoming Meetings</b> ..... 596             | <b>AES Annual Report</b> ..... 605                             |
| <b>Sound Track</b> ..... 597                   | <b>Call for Papers—82nd Convention, London, 1987</b> ..... 606 |
| <b>New Products and Developments</b> ..... 598 | <b>Information for Authors of Convention Papers</b> ..... 608  |
| <b>Available Literature</b> ..... 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

- |   |  |
|---|--|
| <b>Review of Acoustical Patents</b> ..... 670 | <b>Abstracts of Interest</b> ..... 756       |
| <b>News of the Sections</b> ..... 745         | <b>Membership Information</b> ..... 757      |
| <b>Sound Track</b> ..... 749                  | <b>In Memoriam</b> ..... 763                 |
| <b>Upcoming Meetings</b> ..... 752            | <b>Call for Papers—82nd Convention,</b>      |
| <b>Available Literature</b> ..... 753         | <b>London, 1987</b> ..... 764                |
|   | <b>Membership Application Form</b> ..... 766 |

## 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

- |  |     |  |     |
|--|-----|--|-----|
| <b>News of the Sections</b> .....          | 849 | <b>Available Literature</b> .....        | 859 |
| <b>Upcoming Meetings</b> .....             | 852 | <b>Membership Information</b> .....      | 860 |
| <b>Sound Track</b> .....                   | 853 | <b>In Memoriam</b> .....                 | 861 |
| <b>New Products and Developments</b> ..... | 855 | <b>Membership Application Form</b> ..... | 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<sub>cons</sub>** ..... 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

<b>Review of Acoustical Patents</b> .....	910	<b>New Products and Developments</b> .....	946
<b>News of the Sections</b> .....	942	<b>Available Literature</b> .....	948
<b>Sound Track</b> .....	944	<b>Abstracts of Interest</b> .....	949
<b>Upcoming Meetings</b> .....	944	<b>Membership Information</b> .....	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	