BOOK REVIEWS

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Seismic Migration: Imaging of Acoustic Energy by Wave Field Extrapolation (B. Practical Aspects), Vol. 14B of the series, Developments in Solid Earth Geophysics

A. J. Berkhout

Elsevier, Amsterdam, 1984.
xi+274 pp. Price $46.25.

Volumes 14A and 14B of this Elsevier series comprise Professor A. J. Berkhout's extensive discussion of the migration of seismic reflection data. Volume 14A contains a detailed theoretical description of wave field extrapolation and imaging. In Vol. 14B, Berkhout considers the application of various migration techniques to data. Together these volumes amount to the second edition of an earlier volume, Vol. 12.

The first two chapters of Vol. 14B review basic concepts such as Fourier transforms and the principles of wave field extrapolation and imaging. Chapter 3 describes the operational features of migration techniques and some of the underlying assumptions. Chapters 4 through 6 cover problems typical in the migration of field-recorded data: errors caused by inaccurate velocity estimates, problems caused by various types of noise, and limitations imposed by field techniques. The final two chapters cover the practical issues of choosing a migration technique for a given problem and working with the chosen technique to gain an interpretable result.

This volume attempts to reach a diverse readership. One target audience, as identified by an Elsevier brochure, includes practicing seismic data processors and interpreters. To this group, Berkhout is offering a user's guide to migration—an introduction to migration theory and a discussion of input parameters and the evaluation of results. Another audience for this work is clearly those who are conversant with the theory in Vol. 14A. For this group, Vol. 14B contains applications of migration theory to both synthetic and field-recorded data; these data examples are important, as none are included in the theoretical volume.

For both audiences, the strength of this volume lies in the middle chapters. In Chap. 4, Berkhout provides a good analysis of positioning errors and shows synthetic data examples that nicely illustrate the effects of inaccurate velocity estimates. In Chap. 5, he clearly shows how several common field data problems (such as noise bursts and data truncation) affect the migrated result. Both topics are important and have not received much attention in previous texts.

For the practically inclined audience, however, the remainder of this book is likely to be a disappointment. Most data processors and interpreters will find Berkhout's introduction to migration theory difficult to follow; although the preface claims "mathematical detail has been largely omitted," the first two chapters have more than 50 equations apiece. The complexity of this introduction clouds the subsequent discussion of different migration techniques and may discourage some readers from tackling the important chapters noted above.

As a user's guide, the volume has another shortcoming in the chapter on choosing a migration technique for a given set of data. The discussion of this central issue is brief (only a half-dozen pages) and is in large part concerned with details of migration software. Comparative processings of one field and two synthetic data sets are provided, but the discussion of these examples consists only of listing a few conclusions. Data processors and interpreters would appreciate a greatly expanded chapter, including additional field data sets from a range of geologic situations.

For readers who are familiar with the companion volume, the mathematics of Vol. 14B will present no problem. Such readers will generally appreciate the comparison of techniques and the section on imaging principles (which provides some good examples of the effect of recording aperature). Some important practical issues, however, could be more clearly presented. For instance, the problem of lateral velocity variation is mentioned several times but the only data example showing how this affects migrated results is hardly discussed. Similarly, Berkhout describes the operational aspects of 3-D migration, but an example comparing the results of 2-D and 3-D migration would be a valuable addition.

While Vol. 14B makes a difficult introductory text on migration, the material presented is an important complement to Berkhout's theoretical description. This book does contain valuable material for the practically inclined reader; a full appreciation of some topics, however, may require consulting someone who has read Vol. 14A.

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Foundations of Computer Music

Curtis Roads and John Strawn, Eds.

MIT, Cambridge, MA, 1985.
xiii + 712 pp. Price $50.00.

Within the last 10 years, computer music has started a revolution. We have already witnessed a change in the way music is composed, performed, and recorded, and the end is not yet in sight. Many of the key advances have been chronicled in the articles of *Computer Music Journal*, the first three volumes of which have been collected to form *Foundations of Computer Music*.

The 712-page book is conveniently organized by topic, and many of the 36 original articles have been revised to incorporate more up-to-date information. All material has been carefully typeset, including numerous tables, figures, and illustrations. References are given at the end of each article, and a handy note is added to each reference that is reprinted in this volume. In addition, the editors have provided an overview to each of four parts.

Part I, "Digitial Sound-Synthesis Techniques," contains a mixture of theory and practice, ranging from mathematical derivations to compositional techniques. The emphasis here is on algorithms and the resulting sound as opposed to hardware or software implementations. Six of the eleven articles in this section address various aspects of FM synthesis, a technique that has received renewed interest with the availability of low-cost commercial synthesizers based on FM. Excellent introductions to waveshaping, granular synthesis, and analysis/synthesis techniques are also provided in part I.

Part II, "Synthesis Hardware and Engineering," provides a detailed look at the design of a number of music-oriented signal processors. Because of advances in integrated circuit technology, most of these designs are obsolete, although there are still lessons to be learned from a study of their architecture. Unfortunately, most of these articles were written before there

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was much practical experience with the designs, and little if any criticisms are offered. In the process of revising articles, it would have been interesting to have asked the authors to reevaluate their designs in the light of experience.

Part III, "Software Systems for Music," contains articles on a number of topics, illustrating the wide range of approaches that have been taken to coax music out of machines. "The SSSP Score-Editing Tools," by Buxton *et al.*, describes work on graphics-based interactive programs that is still state-of-the-art. Road's "Grammars as Representations for Music" is an excellent survey of formal grammar schemes and their application to music analysis and composition. Three articles discuss problems of controlling synthesis hardware by computer. The one by Rolnick offers some interesting insights into the interaction between hardware and software design trade-offs. Chadabe and Meyers describe an interactive real-time system called "PLAY," and Bartlett describes programs for real-time stochastic music generation.

This part also includes a few articles that directly consider artistic issues of computer music. "An Interview with Gottfried Michael Koenig," by Roads contains statements by Koenig about his compostions and his views on computer music. "Music for an Interactive Network of Microcomputers," by Bischoff, Gold, and Horton, concentrates equally on the technical and philosophical aspects of their collaborative work, in which three small computers were programmed to improvise, responding to information that was exchanged as the music progressed.

Part IV, "Perception and Digital Signal Processing," contains only three articles. Moorer's article on reverberation reviews previous attempts at producing natural-sounding reverberation and offers some practical suggestions. Wessel's article discusses timbral analogies and the use of multidimensional scaling techniques to classify timbres in a two-dimensional space. Finally, McAdams and Bregman review research on the perception of musical streams and its implications for musicians.

Overall, this book contains a wealth of information and should be considered essential reading for the serious student or practitioner of computer music. On the other hand, most of the material is too advanced for the layman, and reading this book is not sufficient to acquire a broad background in the field. In particular, significant advances have been made in areas that are not even addressed by this collection of articles. Furthermore, no sound examples are provided to illustrate the subject matter, and the emphasis is on technical rather than artistic issues.

In spite of these shortcomings, *Foundations of Computer Music* offers a number of interesting articles which were previously hard to find. Reading them as a collection helps give one a sense of how the computer music revolution started and hence a better understanding of where it may be going.

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Proceedings of the Technical Program, Volumes I and II (INTER-NOISE 84), 1984 International Conference on Noise Control Engineering, 3–5 December 1984

George C. Maling, Jr., Ed.

Noise Control Foundation, Poughkeepsie, New York, 12603. 1426 pp. Price $65 for set.

The United States Institute of Noise Control Engineering (INCE/USA) has been organizing international technical meetings since 1972. The most recent meeting, held in Honolulu, HI, was organized jointly with INCE/JAPAN with the theme "International Cooperation for Noise Control." It appears from the two-volume set of *Proceedings* that they succeeded very well.

By my count, 297 technical papers were presented at the meeting. Of these papers, about 34% were authored by North Americans, 29% by Japanese, and 28% by Europeans. The remaining 9% were by participants from South America, the Middle East, China, and Australia.

The technical meeting papers have been grouped for the purpose of these *Proceedings* into ten major groups. They are Distinguished Lecture Series; General; Emmission—Noise Sources; Physical Phenomena; Noise Control Elements; Vibration—Generation, Transmission, Isolation, and Reduction; Immission—Physical Aspects of Environmental Noise; Immission—Effects of Noise; Analysis; and Requirements. The *Proceedings* contain two additional sections, a Forward and a "Special Report on INCE Technical Activities," prepared by Dr. William Lang, the Chairman of INTER-NOISE 84.

These *Proceedings* are an excellent summary of the work being conducted in noise control engineering around the world. The Japanese papers are particularly impressive in their content and quality. As is usual with *Proceedings* of large meetings with too many technical papers, the written record of the oral presentation is usually a summary of a summary. The printed paper contents only tease and encourage one to attempt to learn more by contacting the author, sometimes a difficult undertaking.

Most of the papers describe the state of the art, as perceived by the author, in areas familiar to the noise control community. Two technical areas have blossomed since the last INCE/USA INTER-NOISE meeting. They are Sound Intensity and Active Attenuation.

The *Proceedings* begin with two distinguished lectures presented by Prof. Juichi Igarashi of Japan on the "Japanese Experience in Transportation Noise Control," and by Prof. Malcolm Crocker of the USA on the "Direct Measurement of Sound Intensity and Practical Applications in Noise Control Engineering." Professor Igarashi describes the noise control effort in Japan as it is related to road traffic, aircraft, and high-speed railway noise. Noise models and results are discussed. Professor Crocker begins his lecture with an interesting review of the tools and instruments used in the last century for the qualitative observation of sound. His introduction to the theoretical background and instrumentation used in intensity measurements form a base for understanding the many papers on the subject which follow.

Almost all categories of noise control engineering, as researched and practiced by the authors from 26 countries, are discussed in these *Proceedings*. There are numerous papers on transportation noise with discussions of airport/aircraft noise by West German investigators and road traffic noise by investigators from many nations. Other papers include construction noise, community response to noise, sound power measurements, and many others. An important companion document to these *Proceedings* is the "INTER-NOISE 84" program which better identifies the papers by subject. The papers are organized in the *Proceedings* using the INCE Classification of Subjects which is found at the beginning of Vol. I.

Of some interest is the progress which is being made in active attenuation and sound intensity. A majority of the papers on sound intensity can be found in Vol. II, pp. 1047–1208. These papers describe the investigators' results in the measurement and application of sound intensity. Papers summarize work accomplished in obtaining source identification, panel loss factor, sound power, radiation efficiency factors, transmission loss values, and sound absorption coefficients using acoustic intensity methods. Other papers summarize the work accomplished in understanding the errors which are part of these methods. Gade's paper discusses three major sources of error which affect the validity of sound intensity measurements; microphone spacing approximation error, phase mismatch error, and random errors. Forssen and Crocker emphasize the finite difference error due to the microphone spacing while Steyer *et al.* discuss the errors due to scattering effects and Wagstaff *et al.* discuss the effects of interference on accuracy.

While our knowledge about sound intensity is still developing, committees are moving forward to develop sound intensity measurement standards. The efforts of ASTM's E-33 committee, ANSI S1.12 committee, ANSI S12-21 working group, and ANSI S1.11 working group are discussed in four papers by Lang, Krishnappa and Seybert, Crocker and Nedzelnitsky, respectively. Crocker provides an outline of the proposed standard for the determination of sound power using acoustic intensity methods. Krishnappa and Seybert's paper contains a questionnaire which the reader might wish to complete and submit to the S1.12 committee.

The papers on active attenuation are grouped under "Noise Control Elements" and appear from pp. 443–508. Guicking and Rollwage present an overview summary which discusses solved and unsolved problems in the use of active systems in room acoustics. The papers range from theoretical treatments of the adaptive control problem to the economics of active attenuation devices in ducts. Eghtesadi *et al.*, in discussing the economics of active attenuation, suggest that a substantial cost savings in operating costs can be achieved by use of an active attenuator in combination with a conventional silencer. Gan, from the Republic of Singapore, suggests the use of active attenuators for the reduction of infrasound and provides some theory