Workshop Meeting—Seismic Waves in Laterally Inhomogeneous Media II

Castle of Liblice (near Prague), Czechoslovakia
June 6-11, 1983
An Unofficial Report (the first two days)

They came from far, they came from near,
They came to argue and to hear
The latest methodology
For what concerns seismology.
Czech organizers did things right,
Carefully chose the meeting site
In rural setting, far from town,
A castle, no less, with renown.
Since two to four slept in a room,
This did away with lonely gloom.
At night one heard some knocks and creaks
And also strangely sounding squeaks,
Which made one feel that our host
Might be a friendly castle ghost.
But it turned out, we need not fret.
Someone just went a la toilette.

The sessions went from morn' till late.
We heard a lot. There was debate.
All are spurred on by common quest.
Each seeks a method that works best
For analyzing transient squiggle
In media that are mean and fickle.
But nothing's "best", all have their quirk,
Though, hopefully, *sometimes* they work.
Yet progress did indeed take place.
Ray programs having caustic trace
Where, in the close vicinity,
The fields tend to infinity,
Were treated, patched up, smoothed, and smeared
Until the trouble disappeared.
Its phase space, spectra, Gaussian beams,
Nightmare for one, another's dreams.

Throughout, there was a keen endeavor
To bring out models showing clever
Attempts to get at propagation
Where there is lateral variation.
Computer time should be reduced,
As long as numbers are produced,
Apart from practicality,
Describe what is reality.

We learned a lot. We saw new trends.
We met old, and made new friends.
We ate well, drank, went for a stroll.
We must applaud, we must extol
The splendid hospitality
Sincere, without banality,
The old traditions, culture, pride,
Which our Czech hosts did provide.

This meeting we shall all recall.
I speak a toast: Thanks one and all!

L. Felsen

The Stanford Exploration Project bibliography of published papers arranged by subject

Richard Ottolini and Jon F. Claerbout

Introduction

This is a list of papers published and in press as a result of research at the Stanford Exploration Project. The papers going to press by 1984 will probably be collected into a book to be published by the IHRDC tentatively titled *The Stanford Exploration Project: The First Decade 1973-1983.* Please tell us of any omissions and errors.

Wave equation migration

Claerbout, J.F., Coarse grid calculations of waves in inhomogeneous media with application to delineation of seismic structure, 1970, Geophysics, v. 35, p. 407-418.

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Claerbout, J.F. and Johnson, A.G., Extrapolation of time dependent waveforms along their path of propagation, Geophysical Journal of the Royal Astronomical Society, v. 26, p. 285-295.

Claerbout, J.F. and Landers, T., 1972, Numerical calculations of elastic waves in laterally inhomogeneous media, Journal of Geophysical Research, v. 77, p. 1476-1482.

Clayton, R.W. and Engquist, B., Absorbing side boundaries for acoustic and elastic wave equations, 1977, Bulletin of the Seismological Society of America, v. 66, p 1529-1549.

Clayton, R.W. and Engquist, B., Absorbing side boundary conditions for wave equation migration, 1980, Geophysics, v. 45, p. 895-904.

Brown, D.L., Applications of operator separation in reflection seismology, 1983, Geophysics, v. 48, p. 288-294.

Levin, S.A., Rothman, D. and Rocca, F., Residual migration: applications and limits, Expanded abstracts of the 1983 SEG Meeting, p. 393-395.

Time series

Robinson, E.A. and Claerbout, J.F., The error in least squares inverse filtering, 1964, Geophysics, v. 29, p. 118-128.

Claerbout, J.F. and Muir, F., Robust modeling with erratic data, 1973, Geophysics, v. 38, p. 826-844.

Godfrey, R., Muir, F. and Rocca, F., Modeling seismic impedance with Markov chains, 1980, Geophysics, v. 45, p. 1351-1372.

Tufekčić, D., Claerbout, J.F. and Rašperić, Z., Spectral balancing in the time domain, 1981, Geophysics, v. 46, p. 1182-1188.

Godfrey, R. and Rocca, F., Zero memory non-linear deconvolution, 1981, Geophysical Prospecting, v. 29, p. 189-228.

Hale, I.D. and Claerbout, J.F., Butterworth dip filters, 1983, Geophysics, v. 48, p. 1033-1038.

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Harlan, W.S., Claerbout, J.F. and Rocca, F., Extracting velocities from diffractions, Expanded abstracts of the 1983 SEG Meeting, p. 574-577.

Multiple reflections

Riley, D. and Claerbout, J.F., 2-D multiple reflections, 1976, Geophysics, v. 41, p. 592-620.

Estevez, R. and Claerbout, J.F., Wide angle diffracted multiple reflections, 1982, Geophysics, v. 47, p. 1255-1272.

Morley, L. and Claerbout, J.F., Predictive deconvolution in shot-receiver space, 1983, Geophysics, v. 48, p. 513-531.

Migration before stack

Claerbout, J.F. and Doherty, S., Downward continuation of moveout corrected seismograms, 1972, Geophysics, v. 37, p. 741-768.

Yilmaz, O. and Claerbout, J.F., Prestack partial migration, 1980, Geophysics, v. 45, p. 1753-1779.

Clayton, R.W. and Stolt, R.H., A Born-WKJB inversion method for acoustic reflection data, 1981, Geophysics, v. 46, p. 1559-1567.

Deregowski, S.M. and Rocca, F., Geometrical optics and wave theory of constant offset sections in layered media, 1981, Geophysical Prospecting, v. 29, p. 374-406.

Jacobs, A. and Claerbout, J.F., The prestack migration of profiles, submitted to Geophysics.

Ottolini, R. and Claerbout, J.F., Migration of common midpoint slant stacks, submitted to Geophysics.

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Hale, I.D., Dip moveout by Fourier transform: Expanded abstracts of the 1983 SEG Meeting, p. 271-273.

Velocity analysis

Doherty, S.M. and Claerbout, J.F., Structure independent seismic velocity estimation, 1976, Geophysics, v. 41, p. 850-881.

Claerbout, J.F. and Schultz, P., Velocity estimation by wavefront synthesis, 1978, Geophysics, v. 43, p. 691-714.

McMechan, G.A. and Ottolini, R., Direct observation of a p-tau curve in a slant stacked wavefield, 1980, Bulletin of the Seismological Society of America, v. 70, p. 775-789.

Clayton, R.W. and McMechan, G.A., Inversion of reflection seismic data by wavefield continuation, 1981, Geophysics, v. 46, p. 860-868.

McMechan, G.A., Clayton, R.W. and Mooney, W.D., Application of wave field continuation to the inversion of refraction data, 1982, Journal of Geophysical Research, v. 87, p. 927-936.

Lynn, W.S. and Claerbout, J.F., Velocity estimation in laterally varying media, 1982, Geophysics, v.47, p. 884-897.

Gonzalez-Serrano, A., and Claerbout, J.F., Wave equation velocity analysis, submitted to Geophysics.

Gonzalez-Serrano, A. and Yedlin, M.J., Ray equations in retarded Snell midpoint coordinates, submitted to Geophysics.

Thorson, J.R., Invertibility of velocity stacks: Expanded abstracts of the 1983 SEG Meeting, p. 273-276.

Rocca, F. and Toldi, J., Lateral velocity anomalies, Expanded abstracts of the 1983 SEG Meeting, p. 572-574.

Potpourri

Kjartansson, E., 1979, Constant Q wave propagation and attenuation, 1979, Journal of Geophysical Research, v. 84, p. 4737-4748.

McMechan, G.A. and Yedlin, M.J., Analysis of dispersive waves by wavefield transformation, 1981, Geophysics, v. 46, p. 869-874.

Lynn, H.B. and Deregowski, S., Dip limitations on migrated sections as function of line length and recording time, 1981, Geophysics, v. 46, p. 1392-1397.

Ottolini, R., Sword, C., and Claerbout, J.F., Online movies of reflection seismic data, submitted to Geophysics.

Červený, V., 1983, Synthetic body wave seismograms for laterally varying layered structures by the Gaussian beam method: Geophysical Journal of the Royal Astronomical Society, v. 73, p. 389-426.

Research Personnel

Kamal Al-Yahya received a B.S. degree in physics from the University of Petroleum & Minerals, (city), 1980; joined ARAMCO after graduation and with an ARAMCO scholarship attended U.C., Berkeley, 1981-1983, receiving an M.S. in engineering geoscience. Still under ARAMCO sponsorship, he is now a Ph.D. candidate at Stanford and a member of the SEP.

Robert Burridge is a Professor at the Courant Institute of Mathematical Sciences, New York University, New York, New York, who was a Visiting Scholar at the SEP. He is currently at the University of Wyoming, Laramie.

Jon F. Claerbout received his education at M.I.T. (B.S. physics, 1960, M.S. geophysics, 1963, Ph.D. geophysics, 1967). He worked for United Electrodynamics (now Teledyne, Inc.) in 1963 and studied in Uppsala, Sweden, in 1964. He joined the geophysics faculty at Stanford University in 1967. From 1967 to 1973, he was a consultant to the Chevron Oil Field Research Company. He is an active member of the Society of Exploration Geophysicists, receiving the Best Presentation Award for a paper, "Extrapolation of Wave Fields," presented at the 1972 international SEG meeting, and receiving the Society's Medal Award in 1973 "in recognition of his outstanding and original pioneering work in seismic wave analysis." During the year 1972-73, he was a visiting research geologist at Princeton University and a visiting lecturer at Sydney University. His textbook **Fundamentals of Geophysical Data Processing** was published in 1976 and translated to Chinese (1979) and Russian (1981). In 1977, he was elected a Fellow of the American Geophysical Union. In 1979, he joined the MIT Corporation Advisory Committee to Earth Sciences. During the 1979-80 year he was on sabbatical leave at the Department of Geodesy and Geophysics, Cambridge University. He is professor of geophysics at Stanford University and director of the Stanford Exploration Project.

Paul Fowler studied at Reed College and Portland State University, receiving a B.S. degree in mathematics and earth sciences in 1981. During 1982 he worked as a seismologist for the U.S. Army Corps of Engineers. He is currently working toward a Ph.D. in geophysics at Stanford and is the recipient of an NSF graduate fellowship. He is a student member of SEP, AGU, and SSA.

William Harlan received a B.S. in geophysics from Texas A & M University in 1981, under a scholarship from the SEG. During the summer of 1980, he worked as a seismic interpreter for Conoco in Midland, Texas. After graduation, he became a Conoco researcher, constructing an interactive three-dimensional ray-tracing package for the modeling and migration of horizon maps. In 1981 he joined the SEP as a Ph.D. candidate at Stanford. His present research includes the application of estimation theory to the extraction of rock parameters from sparse and noisy data.

Stewart A. Levin received a B.A. in Mathematics from Princeton in 1975 and an M.S. in Mathematics in 1978 from Stanford. From 1979-1982 he worked at Western Geophysical, Houston, as a Senior Research Geophysicist. He joined the SEP in September 1982.

Zhiming Li received a B.S. in geophysics from the East-China Petroleum Institute in 1982. His thesis included (1) Maximum Entropy Deconvolution and (2) the Relationship between Partial Correlation Coefficients and the Reflection Coefficients. Before coming to Stanford, he was a graduate student of the Peking Graduate School of E.C.P.I. He is currently a Ph.D. candidate and a member of the SEP.

Peter Mora received a B.Sc. degree in geophysics (1978) and a B.Sc. Honours degree (1979) from the University of Adelaide, Australia. His Honours thesis involved 2D ray tracing to study moveout functions and interval velocities. He worked for Esso, Australia, as a geophysicist and programmer and later consulted to Delhi Petroleum developing forward modeling software including ray tracing and finite difference schemes. He is currently a Ph.D. student in geophysics at Stanford, working with the SEP.

Richard Ottolini received a Ph.D in geophysics from Stanford in 1983, M.S. in geophysics in 1978, and B.S. from M.I.T. in 1976. His thesis "Migration in Angle-Midpoint Coordinates" appeared as SEP-33. He is a consultant in exploration seismology, graphics, artificial intelligence and computer design to the SEP and various companies in Silicon Valley.

Joshua (Shuki) Ronen received a B.Sc. in physics and in geology from the Hebrew University at Jerusalem in 1981. During his B.Sc. studies he worked as a research assistant in the Physics Department and spent a summer at the Geology Department in the Hebrew University. He is now working toward a Ph.D. in geophysics at Stanford.

Daniel Rothman received an A.B. in applied mathematics from Brown University in 1979. He then worked for Western Geophysical Company as a research geophysicist in Houston, Texas, and London, England, developing and testing a variety of seismic data processing algorithms. In March, 1982 he joined the SEP and is currently working toward his Ph.D. in geophysics. Dan is a recipient of a fellowship from the Amoco Foundation. He is a member of SEG, EAEG, and AGU.

Chuck Sword received a B.S. in physics from Stanford University in 1980. That summer he worked at Marathon Oil Company's Denver Research Center, where he helped process experimental marine data and implement a migration scheme. He joined the SEP in September 1980 and is working toward a Ph.D. in geophysics. During the summer of 1982 he worked at Chevron Research in La Habra. While there he worked on computer graphics for the interpretation of seismic data and studied some forward-modeling methods. In September he left for nine months of study at the Gubkin Institute of Petrochemical and Gas Industry in Moscow. Chuck is expected back next summer to continue his work toward a Ph.D. in geophysics.

Jeff Thorson received a B.S. degree in geology from the University of Washington in 1973 and an M.S. degree in geophysics from the University of Houston in 1975. He has worked for Getty Oil Company as an interpreter and in the field as a company representative on various seismic surveys. He is a member of SEG and EAEG, and has been the recipient of an N.S.F. graduate fellowship.

John Toldi received a B.S. in physics and an M.S. in geophysics from Stanford University in 1978. He then worked for Chevron Geosciences, Houston, in seismic data processing and later in a programming and evaluation group. In January 1982 he joined the SEP and is currently working toward a Ph.D. in geophysics.

Ronald Ullmann received his B.S. in geophysics from Texas A & M University in 1981. During the summer of 1980, he worked for the Oklahoma Division of Getty Oil Company as an assistant geophysicist. The summer of 1981 he worked at Chevron Oil Field Research Company in La Habra, California, where he wrote computer programs to compute seismic wave velocities in saturated, porous rocks. He joined the SEP in September of 1981 and is working on his Ph.D. in geophysics. He is the recipient of an N.S.F. graduate fellowship and a student member of the SEG.

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