# MULTICHANNEL INVERSION IN REFLECTION SEISMOLOGY

A DISSERTATION
SUBMITTED TO THE DEPARTMENT OF GEOPHYSICS
AND THE COMMITTEE ON GRADUATE STUDIES
OF STANFORD UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

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December 1985

printed as Stanford Exploration Project Report No. 46
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## ABSTRACT

Adequate sampling of the reflected wavefield is required to produce high resolution images of the earth's interior from reflection-seismic data. Often, especially in three-dimensional surveys, spatial sampling is inadequate, and the result is spatial aliasing and loss of resolution. While spatial aliasing is a missing data problem, the available data are multichannel, and summing (stacking) is used to merge information from different channels. The goal of this thesis is to use the multichannel data in the most effective way to overcome spatial aliasing.

A linear operator whose formulation is based on the wave equation relates the potentially aliased seismic data to the model: the ideal, well-sampled, zero-offset section. Inversion of that operator is multichannel inversion.

Treating missing data as zero data and performing partial migration before stacking are equivalent to the application of the transpose of the operator we need to invert. This processing is adequate only in the absence of spatial aliasing.

I used a conjugate-gradient-inversion program and found that convergence was achieved in less than ten iterations. The first iteration was equivalent to conventional processing. Following iterations showed substantial improvement relative to the first.

Separation of the multichannel inversion to many small inversions, one for each spatial frequency, is possible when the sampling is uniform and assuming that lateral velocity variations are mild. Full separation in both space and time is possible using the log and the Fourier transforms. (The log transform is the resampling of the data in the logarithm of the time).

As applied to synthetic and field data, multichannel inversion, combined with spatial spectral balancing, was effective in overcoming spatial aliasing.

## Acknowledgements

I was fortunate to have the guidance of two advisors: Fabio Rocca with whom I started to work on DMO and spatial aliasing, and Jon Claerbout who was with me all along (yet giving me the feeling I was doing it all by myself). Fabio's resourcefulness and Jon's insight and steadiness were a strong combination.

The Stanford exploration project (SEP) has been a great research environment, both in the early stage when I was learning about geophysical processing and in the later stage when I was working on specific subjects. Thanks are to the members and sponsors of the SEP.

Last but not least, I am grateful to my wife Sabrina for coming with me to America, and to my daughter Keshet for her masterpiece contribution (filler page 58).

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