Conclusions

Based on the wave equation, linear relations

$$\mathbf{d} = \mathbf{G}\mathbf{m}$$

were formulated between the model vector $\mathbf{m}$ (the ideal zero-offset section), and the data vector $\mathbf{d}$ (the seismic data after NMO). Multichannel inversion is the the process of solving those linear relations.

Treating missing data as zero data and performing partial (or full) migration before stacking are equivalent to the application of the transpose operator

$$\hat{\mathbf{m}} = \mathbf{G}^{*}\mathbf{d} \ .$$

This processing, which is adequate in the absence of spatial aliasing, was used as a first iteration in a conjugate-gradient inversion. Subsequent iterations generated significantly better results.

Overcoming spatial aliasing requires a combination of data processing and careful design of seismic surveys. In this thesis, I put the emphasis on the data processing: the inversion of $\mathbf{G}$, but the survey-design is crucial: $\mathbf{G}$ is data independent but it depends on the *recording geometry.* If the midpoint interval is small enough spatial aliasing is avoided, $\mathbf{G}$ is unitary, and conventional processing is adequate. When spatial aliasing cannot be avoided it can be overcome by multichannel inversion, provided the survey is well designed. My main conclusion for survey design is that the offset vectors in three-dimensional surveys should be in various directions.

Multichannel inversion, combined with spatial spectral balancing is a powerful technique for overcoming spatial aliasing.

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