Correction for Spurious Phase via Nonlinear Optimization-Application in Real Data

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Summary
Conventional deconvolution assumes a minimum phase wavelet in the data. In reality, the data may not always contain a minimum phase wavelet. Hence, removal of such a wavelet will leave behind a spurious phase component in the data. A nonlinear optimization scheme is adopted to estimate the spurious phase component. Accuracy of the algorithm is tested by comparing with band-pass filtered data obtained from thin-bed reflectivity inversion algorithm. The comparison shows reasonable accuracy in terms of de-phasing of the spurious phase from the data.

Introduction
The primary objective of seismic exploration is to obtain accurate information about the subsurface structures which are generally characterized by the reflectivity series. Deconvolution, under the assumption the wavelet is minimum phase, may not be always be accurate as an unwanted phase component will be left behind in the data after deconvolution. The paper adopts a nonlinear optimization technique (Misra and Sacchi, 2007) to estimate the spurious phase component in the data and subsequently remove it. The results are compared with thin-bed reflectivity algorithm inversion where the inverted data are convolved with a zero-phase wavelet.

Method
The unknown wavelet is parameterized as the convolution of a minimum phase wavelet with an all-pass operator. The estimated minimum phase wavelet is deconvolved from the data and the 4th order cumulant of the whitened data is compared with the 4th order moment of the all-pass operator. The all-pass operator is parameterized as a Z-transform given by the ratio, where the denominator term is a minimum phase sequence (Porsani and Ursin, 1998). The coefficients of the all-pass operator are obtained by the simulated annealing algorithm (Misra and Sacchi, 2007). The phase component in the estimated all-pass operator is subsequently removed from the whitened data. The scheme is applied on real stacked data. The data obtained after the necessary phase correction are compared with the band-pass filtered data obtained from the thin-bed reflectivity inversion algorithm.

Conclusion
The results show successful application of the algorithm in real data situation.

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References
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