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Implementation of Elastic Prestack Reverse-Time Migration Using an Efficient Finite-Difference Scheme

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A b s t r a c t

Elastic reverse-time migration (RTM) can reflect the underground elastic information more comprehensively than single-component P-wave migration. One of the most important requirements of elastic RTM is to solve wave equations. The imaging accuracy and efficiency of RTM depends heavily on the algorithms used for solving wave equations. In this paper, we propose an efficient staggered-grid finite-difference (SFD) scheme based on a sampling approximation method with adaptive variable difference operator lengths to implement elastic prestack RTM. Numerical dispersion analysis and wavefield extrapolation results show that the sampling approximation SFD scheme has greater accuracy than the conventional Taylor-series expansion SFD scheme. We also test the elastic RTM algorithm on theoretical models and a field data set, respectively. Experiments presented demonstrate that elastic RTM using the proposed SFD scheme can generate better images than that using the Taylor-series expansion SFD scheme, particularly for PS images. Fur-

thermore, the application of adaptive variable difference operator lengths can effectively improve the computational efficiency of elastic RTM.

Key words: seismic imaging, elastic wave, wavefield extrapolation, finite-difference.