Sparse optimization methods for seismic wavefields recovery

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Due to the influence of variations in landform, geophysical data acquisition is usually sub-sampled. Reconstruction of the seismic wavefield from sub-sampled data is an ill-posed inverse problem. It usually requires some regularization techniques to tackle the ill-posedness and provide a stable approximation to the true solution. In this paper, we consider the wavefield reconstruction problem as a compressive sensing problem. We solve the problem by constructing different kinds of regularization models and study sparse optimization methods for solving the regularization model. The $l_p$-$l_q$ model with $p = 2$ and $q = 0, 1$ is fully studied. The projected gradient descent method, linear programming method and an $l_1$-norm constrained trust region method are developed to solve the compressive sensing problem. Numerical results demonstrate that the developed approaches are robust in solving the ill-posed compressive sensing problem and can greatly improve the quality of wavefield recovery.

*seismic inversion, optimization, sparsity, regularization.*