Widely Convergent Generalized Pulse-Spectrum Technique for 2-D Acoustic Wave Equation Inversion Combining with Plane-Wave Seismograms with Well Logs

G. F. Feng ,B. Han, J. Q. Liu

(Department of Mathematics, Harbin Institute of Technology, Harbin,150001, China)

Generalized Pulse-Spectrum Technique (GPST) is a kind of widely applied and effective method for solving inverse problem of geophysical prospecting. But it has many shortcomings in convergence domain, ability of anti-noise, computation cost and choice of regularized parameter. So the widely convergent generalized pulse-spectrum technique is introduced and studied for the inverse problem on 2-D wave equation in the seismic prospecting in detail. In this paper we try to construct a new perfect method for the inverse problem on 2-D wave equation.

First, combining widely convergent homotopy method applied to the inversion process of operator identification and Tikhonov regularization method for ill-posed problem we introduce Regularization-Gauss-Newton method and Widely Convergent Generalized Pulse-Spectrum Technique (WCGPST). Especially the latter is widely convergent, stable and able to restrain noises.

Second, the well log is introduced in the 2-D wave equation inversion for Widely Convergent Generalized Pulse-Spectrum Technique (WCGPST). The relative numerical simulations indicate the robustness of the methods is improved with the increase of the known information.

The inversion methods given in this paper synthetically overcome the defects of ordinary generalized pulse-spectrum technique to some extent and have meaningful significance in theory and practice.

Key Words: inverse problem of geophysical prospecting; nonlinear inversion; 2-D wave equation inversion; generalized pulse-spectrum technique; constraint inversion