

Prestack Gaussian-Beam Depth Migration in Anisotropic Media

Tianfei Zhu*

Veritas DGC Inc, Calgary, Alberta, Canada

Tianfei_Zhu@veritasdgc.com

and

Sam Gray and Daoliu Wang

Veritas DGC Inc, Calgary, Alberta, Canada

Abstract

Gaussian-beam (GB) depth migration (Hill, 1990, 2001) is an appealing alternative to Kirchhoff and wave-equation (WE) migrations: It overcomes the inability of Kirchhoff migration in imaging multiple arrivals while retaining its efficiency and its capability of imaging steep dips with turning rays. By directionally downward extrapolating local plane waves instead of single-trace scattered waves, GB migration also avoids the migration swinging noises inherent in Kirchhoff migration, resulting in clean subsurface images comparable to those from WE migration. Furthermore, GB migration is more robust and accurate in amplitude calculation than Kirchhoff migration, making GB depth migration potentially useful for AVO analysis in geologically complex areas.

Extension of prestack GB migration from isotropic to anisotropic media has, however, been hampered in the past by difficulties of kinematic and dynamic raytracing in inhomogeneous anisotropic media. Formulated in terms of elastic parameters, the traditional anisotropic raytracing systems are complicated to implement and inefficient for computation. To overcome these difficulties, we have reformulated the raytracing systems in terms of phase velocity. The new formulation is much simpler and more efficient than the traditional formulation, especially for the dynamic raytracing system. Using this new formulation, we have extended GB prestack depth migration to anisotropic media. Experiments with synthetic and field data show that our anisotropic GB migration is efficient and accurate, producing images superior to those produced by anisotropic Kirchhoff migration.