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Arbitrarily Wide-Angle Wave Equations and their Applications to Unbounded Domain Modeling and Subsurface Imaging

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One-way wave equations (OWWEs) are special mathematical constructs that allow propagation of waves in a 180-degree range of angles (as opposed to normal 360-degree range for regular wave equations). Due to this property, OWWEs found applicability in modeling wave propagation in unbounded domains and in imaging. Exact OWWEs are often not amenable for computation and must be approximated. This paper presents new approximations of OWWEs: Arbitrarily Wide-angle Wave Equations (AWWEs). Unlike the existing approximations, AWWEs are applicable and accurate for one-way propagation of complex waves in heterogeneous, anisotropic, porous visco-elastic media. This presentation briefly describes the underlying ideas of AWWEs and illustrates AWWEs' accuracy in modeling propagating as well as evanescent waves. In addition, AWWE-based procedures are developed for imaging of defects in solids and for modeling wave propagation in unbounded domains. Results from these procedures will be compared with those from existing methods to illustrate the effectiveness of AWWE.

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