Local Radial Basis Functions for Helmholtz Equation in Seismic Inversion

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Abstract

Solutions of Helmholtz equation are essential in Seismic imaging methods like full wave inversion, which needs to solve many times the wave equation. Traditional methods like Finite element method (FEM) or Finite differences (FD) have sparse matrices but may suffer the so called pollution effect in the numerical solutions of Helmholtz equation for large values of the wave number. On the other side, global radial basis functions have a better accuracy but produce full matrices that become unstable.

In this research we combine the virtues of both approaches to find numerical solutions of Helmholtz equation, by applying a meshless method that produces sparse matrices by local radial basis functions. We solve the equation with absorbing boundary conditions of the kind Clayton-Enquist and PML (Perfect Matched Layers) and compare with results in standard literature, showing a promising performance by tackling both the pollution effect and matrix instability.