Localized Meshfree Methods for Solving 3D-Helmholtz Equation

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Abstract : In this study, we develop local meshfree methods known as radial basis function-generated finite difference (RBF-FD) method and Hermite finite difference (RBF-HFD) method to design stencil weights and spatial discretization for Helmholtz equation. The convergence and stability of schemes are investigated numerically in three dimensions with irregular shaped domain. These localized meshless methods incorporate the advantages of the RBF method, finite difference and Hermite finite difference methods to handle the ill-conditioning issue that often destroys the convergence rate of global RBF methods. Moreover, numerical illustrations show that the proposed localized RBF type methods are efficient and applicable for problems with complex geometries. The convergence and accuracy of both schemes are compared by solving a test problem.

Keywords : radial basis functions, Hermite finite difference, Helmholtz equation, stability
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