

**The Learning Based Numerical Solutions for Partial Differential Equations**

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Numerical methods for partial differential equations are the important and powerful tools for the engineering problems. The study of numerical methods for PDE is one of the hottest research topics in the applied mathematics and computational mathematics. Based on ideas from data learning and inverse problems, we propose a new method for finding numerical solutions of differential equations effectively, especially for the Helmholtz equations with the high wave numbers. The main idea of this method is to construct the approximation solutions by utilizing the relevant information from the solution we already have, which include the explicit solutions, the measured data from the experiments, the expression of the basic solution and the numerical solution obtained from the numerical experiments, etc. This is also a fast and high-precision numerical algorithm. It is shown that, especially for high-frequency problems, this method provides feasible solutions.