

## A Directional Method of Particular Solution for Solving the 3D Poisson Equation

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**Abstract:** In this article, a directional method of particular solution (DMPS) is derived to solve the 3D Poisson equation in an arbitrary domain. The proposed DMPS for the 3D problems are based on the 2D particular solution. Together with the directional technique we can construct the 3D particular solution easily by introducing a series of planar directors into the 2D particular solution. The intensities of the basis functions are determined by imposing the boundary condition on the boundary collocation points. Besides, the inverse Cauchy problems are also addressed in this article. The inverse problems are highly ill-posed in nature. In order to deal with the resultant ill-posed linear system obtained by discretizing the inverse problem, the pre- and the post-conditioners are adopted to reduce the condition number of the system matrix. The propose basis functions are highly accurate, meshless, free from numerical quadrature, and easy to implement. Several numerical examples are provided to validate the performance and the stability of the proposed algorithm.

**Keywords:** Directional Method of Particular Solution (DMPS); 3D poisson equation; meshless method