Review of: "Taylor Series Based Domain Collocation Meshless Method for Problems with Multiple Boundary Conditions including Point Boundary Conditions"

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Many complex real-world challenges in science and engineering, once formulated, often boil down to solving partial differential equations (PDEs) within a specified domain, subject to relevant boundary conditions. Numerical techniques such as Finite Element Method (FEM), Finite Difference Method (FDM), and Boundary Element Method (BEM) are widely employed and well-established for solving these real-world PDEs. However, in recent decades, significant research efforts have been dedicated to developing meshless methods that eliminate the need for the laborious and time-consuming process of generating high-quality meshes for the domain. Many of these meshless methods encounter difficulties when handling point boundary conditions, which are common in engineering applications.

Therefore, this paper introduces a novel approach to solving PDEs called the Taylor series-based domain collocation PDE solution methodology. This methodology is particularly well-suited for addressing multiple boundary conditions, including point boundary conditions. The core concept behind this method is to formulate a function that satisfies all the specified boundary conditions and then generalize this function into a family of functions using Taylor series expansion. As this family of functions already adheres to the boundary conditions, solving the PDE becomes a matter of determining the values of unknown Taylor coefficients that minimize the residual of the PDE across the entire domain.

By applying the domain collocation method, the originally linear PDE problem transforms into a linear regression problem. The proposed method is further extended by employing multi-point Taylor series to effectively handle problems involving point boundary conditions. The paper demonstrates the successful application of this methodology in solving both homogeneous and non-homogeneous Helmholtz and Poisson's PDEs. Notably, the proposed approach showcases its efficiency by achieving accurate solutions with fewer degrees of freedom (DOFs) compared to the Taylor meshless method (TMM). The paper also illustrates the versatility of the method by solving problems with various types of boundary conditions, including Dirichlet and Neumann conditions. Furthermore, the method is adapted to solve problems where the boundary is defined by a set of discrete points rather than an analytical function.