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

Roberto Pettres[1]

1 Universidade Federal do Paraná

Potential competing interests: No potential competing interests to declare.

Reviewer

Paper:

Taylor Series Based Domain Collocation Meshless Method for Problems with Multiple Boundary Conditions including Point Boundary Conditions

Abstract: Many sophisticated real world science and engineering problems after formulation simply reduce to a problem of finding a solution of partial differential equations (PDEs) with relevant boundary conditions over a domain. Numerical methods like FEM, FDM and BEM are most used and popular methods to solve these real-world PDEs. However, in last few decades considerable amount of research has been dedicated to develop meshless methods which don't involve tedious and time consuming process of generating high quality mesh for the domain. Many of these meshless methods have difficulty in handling point boundary conditions which are quite frequent in engineering applications. Hence, in this paper, a Taylor series based domain collocation PDE solution methodology is proposed. The proposed methodology is well suited to handle multiple boundary conditions including point boundary conditions. The main idea of the method is to formulate a function which satisfies all the boundary conditions and then generalize the function to a family of functions by using Taylor series. Since the family of functions already satisfies the boundary conditions, the PDE solution can be determined by finding the values of unknown Taylor coefficients for which the residual of the PDE over the domain is closest to zero. Using domain collocation method, the linear PDE problem transforms into a linear regression problem. The proposed method is extended by using multi-point Taylor series to solve problems with point boundary conditions. The proposed method has been successfully applied to solve homogenous/non[1]homogenous Helmholtz and Poisson's PDEs in the paper. The proposed methodology has also been shown to solve complex PDEs efficiently with less number of degrees of freedom (DOFs) as compared to Taylor meshless method (TMM). The proposed method is illustrated for both problems with Dirichlet and Neumann boundary conditions. Moreover, the method has been also presented to solve a problem where the boundary is defined using a set of points instead of an analytical function.

Considerations:

1. Are the objectives and the rationale of the study clearly stated?

Yes, the objectives and the rationale of the study clearly stated.

2. If applicable, is the application/theory/method/study reported in sufficient detail to allow for its replicability and/or reproducibility?

Yes [X] No [] N/A []

3. The application/theory/method/study are reported in sufficient detail.

Yes [X] No [] N/A []

4. If applicable, are statistical analyses, controls, sampling mechanism, and statistical reporting (e.g., P-values, CIs, effect sizes) appropriate and well described?

Yes [X] No [] N/A []

5. Could the manuscript benefit from additional tables or figures, or from improving or removing (some of the) existing ones?

Yes [ ] No [X] N/A []

6. If applicable, are the interpretation of results and study conclusions supported by the data?
Reviewer #1: Mark as appropriate with an X:

Yes [X] No [] N/A []

7. Have the authors clearly emphasized the strengths of their study/theory/methods/argument?

Yes [X] No [] N/A []

8. Have the authors clearly stated the limitations of their study/theory/methods/argument?

Yes [X] No [] N/A []

9. Does the manuscript structure, flow or writing need improving (e.g., the addition of subheadings, shortening of text, reorganization of sections, or moving details from one section to another)?

Yes [ ] No [X] N/A []

Future recommendations should be added to help other researchers expand the analysis of the research presented. It is suggested that, if the author deems it necessary, discuss works by other authors that use numerical methods such as FDM, FEM or BEM, whether or not using domain meshes in real applications as presented in the references below, in addition to describe and relate the equations solved in the article with real problems.

I congratulate the author who works as an Independent Researcher for the product developed.

The paper is well written and I recommend it be published.

Pettres, R. A first dynamic population invasion study from reactive-telegraph equation and boundary element formulation. Eng. Anal. Bound. Elem. V. 122, pp 214–31, 2021. https://doi.org/10.1016/j.enganabound.2020.11.002.

Oliveira, J. R. S.; Pettres, R. A thermal analysis of concrete structures performed by layers using boundary element formulation and dual reciprocity, Eng Analysis with Boundary Elements, V.150, pp 542-554, 2023. https://doi.org/10.1016/j.enganabound.2023.02.023

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