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

Abdolmehdi Behroozi[1]

1 Pennsylvania State University

Potential competing interests: No potential competing interests to declare.

The article introduces an innovative approach to solving PDEs, especially those with point boundary conditions, a common challenge in real-world applications. The proposed method employs Taylor series and domain collocation to create a family of functions that meet all boundary conditions, simplifying the PDE problem into a linear regression task. While the article shows promise, it requires addressing major issues such as clarifying the problem statement, providing detailed methodology explanations, offering quantitative results for validation, and improving structure and grammar.

Addressing following concerns will enhance the article's suitability for acceptance:

English wrting:

> *The article exhibits weaknesses in English language usage and should undergo a thorough review by a native English speaker for improvement.*

Abstract:

> *Here are some problems or shortcomings in the original abstract:*
>
> - ***Lack of Clarity on the Problem Statement**: The abstract does not clearly articulate the specific problem or challenge that the proposed methodology aims to address. It mentions point boundary conditions as a challenge but doesn't explain why they are problematic or why they matter in real-world applications.*
> - ***Insufficient Methodology Details**: The abstract mentions the use of Taylor series and domain collocation but doesn't provide enough detail to help the reader understand how these methods are applied to solve PDEs. It lacks a clear step-by-step explanation of the proposed approach.*
> - ***Absence of Numerical Results**: While the abstract claims that the proposed method is efficient and outperforms another method, it does not provide any quantitative results or comparisons to support these claims. Without data or evidence, the reader cannot assess the validity of the findings.*
> - ***Incomplete Scope**: While the abstract mentions the successful application of the methodology to Helmholtz*

> *and Poisson's PDEs, it does not mention the broader range of potential applications or industries where this method might be valuable.*
>
> - ***Structural Issues****: The abstract has some structural problems, including long sentences and a lack of clear transitions between different ideas, making it harder for readers to follow the narrative.*

Introduction and literature review:

> *The Introduction and literature review sections should be rewritten to incorporate recent publications related to meshless methods, enhancing the article's relevance and completeness. Following references related to meshless methods should be added to the introduction:*
>
> 1. *https://doi.org/10.1016/j.enganabound.2023.06.020*
> 2. *https://doi.org/10.1016/j.camwa.2022.11.020*
> 3. *https://doi.org/10.1016/j.enganabound.2023.05.017*
> 4. *https://doi.org/10.1007/s00366-022-01601-0*
> 5. *https://doi.org/10.1016/j.enganabound.2023.05.013*
> 6. *https://doi.org/10.1108/EC-06-2021-0331*
>
> *Incorporating these references will strengthen the introductory section by providing a comprehensive overview of the current state of research in the field of meshless methods.*

Implementation:

> - *A crucial factor requiring consideration is the program's execution time, especially when applied to a domain as large as 100x100. Conducting a comparative evaluation against established numerical techniques would offer valuable insights into the method's computational effectiveness, helping researchers make informed decisions when selecting tools tailored to their specific requirements.*
> - *While the method presented holds promise, its credibility and versatility could be further enhanced through a comprehensive evaluation that includes more complex problem scenarios. Specifically, the authors could delve into situations that encompass Neumann boundary conditions with consistent boundaries, incorporate in-domain and out-of-domain sources, and tackle intricate geometries. Expanding the scope of testing in this manner would contribute to a more robust assessment of the method.*

Conclusion:

> *Several issues can be identified in the provided conclusion:*

- ***Lack of Specific Results**: The conclusion mentions the application of the proposed method to a wide range of problems but lacks specific results or numerical data to support the claim that the method is "very robust." Providing quantitative evidence of the method's performance would enhance the conclusion's credibility.*
- ***Complexity and Singularity**: The discussion about functions becoming singular at some points over the domain and the need for alternative formulations adds complexity to the method. While addressing singularities is important, the conclusion should clarify how this complexity might impact practical implementation.*
- ***Numerical Differentiation**: The mention of numerical differentiation as an alternative to direct differentiation introduces another layer of complexity and potential error sources. It would be helpful to elaborate on the accuracy and efficiency of this approach and compare it to direct differentiation in more detail.*
- ***Handling Point Boundaries**: While the conclusion highlights the method's capability to handle point boundary conditions as a strength, it does not provide concrete examples or comparisons with other methods to demonstrate its effectiveness in this regard.*
- ***Generalization of Results**: The statement that "the method promises to become a standard PDE solver in the future" lacks substantiation. Instead, the conclusion could emphasize the potential and contributions of the method, leaving room for future developments.*
- ***Fidelity in Handling Non-linear PDEs**: The conclusion briefly mentions that further investigations are needed into the method's performance with non-linear and large-scale PDE problems. However, it doesn't specify why or how these investigations should be conducted, leaving the reader with an open-ended statement.*

To improve the conclusion, it should provide specific quantitative results, clarify the practical implications of handling singularities and point boundaries, provide a more detailed evaluation of numerical differentiation, and temper expectations regarding the method's future status. Additionally, it should outline clear directions for future research to address the mentioned limitations.