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Type of manuscript: Article
Title: Quarter-sweep preconditioned relaxation method, algorithm and
efficiency analysis for fractional mathematical equation
Authors: Andang Sunarto *, Praveen Agarwal, Jumat Sulaiman, Jackel Vui Lung
Chew *, Shaher Momani
Received: 23 June 2021
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Dear Dr. Sunarto,

Your manuscript has been assigned to Eric Yan for further processing who will
act as a point of contact for any questions related to your paper.

Journal: Fractal and Fractional
Manuscript ID: fractalfract-1290842
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Kind regards,

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Dear Editor,

With this cover letter, we submit the revised manuscript (**fractalfract-1290842**) entitled *"Quarter-sweep preconditioned relaxation method, algorithm and efficiency analysis for fractional mathematical equation"* for publication in Fractal and Fractional.

We want to thank reviewers for the careful and constructive reviews. Based on the comments from the reviewers, we have made changes to the manuscript, which are detailed below.

Reply to the comments by Reviewer 1

1.   What about the stability analysis of the new numerical approximation?
Reply: Thank you for the comment. In this paper, Theorem 1 is given to state the unconditional stability of the new numerical approximation call the quarter-sweep implicit finite difference approximation via Caputo's time-fractional operator. The presentation of the proof has been revised to make the stability analysis clearer to the readers. Please see Proof of Theorem 1 in Section 4.

2.   Authors have considered two different linear fractional diffusion problems to test the efficiency and accuracy of the numerical method. But it is expected to solve numerically a nonlinear diffusion type problem of fractional order?
Reply: Thank you for the comment. Solving a nonlinear fractional diffusion equation using the quarter-sweep finite difference scheme with Caputo's fractional operator is our current ongoing research. The numerical experiment with a nonlinear fractional diffusion needs a thorough investigation, and hence the publication will take some time.

3.   Authors should correct the grammatical and typo errors placed in the paper.
Reply: Thank you for the comment. The grammatical and typo errors in this paper has been identified as much as possible and fixed accordingly.

4.   Authors should improve the introduction by including the recent development within the frame of the numerical scheme in the Caputo fractional order sense and their illustrative applications with the help of recently published papers.
Reply: Thank you for the comment. The introduction part of the paper has been revised accordingly. Please see Para. 1 in Section 1.

5.   They should extend the concluding remarks section so that it provides and covers all the finding of the paper and future direction.

Reply: Thank you for the comment. The concluding remark section has been revised accordingly. Please see Section 8.

6.   What makes the proposed numerical scheme suitable for this unique task? What new development to the proposed method have the authors added (compared to the existing approaches)? These points should be clarified.

Reply: Thank you for the comment. The answers to the above questions can be referred to in Para. 2 in Section 1.

7.   Have you employed any assumptions in your models? Please explain briefly.

Reply: Thank you for the comment. This paper assumes the solutions exist in the restricted rectangular finite-difference solution domain. The solutions are verified after the numerical solutions converged at a desired tolerance errors in the iteration cycle. Besides that, the examples of the time-fractional diffusion equation are selected due to the existence of exact solutions.

8.   More physical interpretations should be given. Please provide corresponding explanations of the figures in terms of their physical meanings and the pointing out the novelty of the paper. How do figures support your scheme?

Reply: Thank you for the comment. This paper investigates the efficiency of a quarter-sweep scheme via Caputo's time-fractional approximation, which is evaluated based on the number of iterations and execution time at several different mesh sizes. The figures illustrate the improvement in efficiency by the proposed numerical method against the existing works. The discussion section has been expanded to explain the interpretation made based on the collected results. Please see Para. 3 and 4 in Section 7.

9.   In figures, the differences (advantages or disadvantages of the methods) should be clarified.

Reply: Thank you for the comment. Please see Para. 3 and 4 in Section 7.

Reply to the comments by Reviewer 2

1.   It is not clear to me how equation (19) is obtained. Give detailed explanations for that.
2.   Give detailed explanations how equation (23) is obtained.
3.   Stability result should be established for the proposed method defined by equation (15).

Reply: Thank you for these comments. The stability analysis section has been revised accordingly. Please see Section 4.

*4.	The numerical order of convergence of proposed method is not provided in the paper. It is suggested to include it in the paper.*
Reply: Thank you for the comment. The convergence analysis section has been added. Please see Section 5.

*5.	Authors solved very simple numerical examples (special case of equation (3)) using the proposed method to show the applicability of present method. It is suggested to solve more challenging diffusion problems in order to demonstrate the wider applicability of the method.*
Reply: Thank you for the comment. The numerical solution of a more challenging diffusion problem will be investigated further and will be published nearly in the future.

*6.	Literature review on recently developed computational techniques for solving time-fractional diffusion equation is very poor.*
Reply: Thank you for the comment. The literature review in the introduction part of the paper has been revised accordingly. Please see Para. 1 and 2 in Section 1.

*7.	Please check the manuscript carefully for typos and grammar errors.*
Reply: Thank you for the comment. The grammatical errors and typos have been fixed accordingly.

We appreciate the comments from the reviewers. Thank you for reviewing our manuscript.

Sincerely,
Andang Sunarto

 Gmail   **Andang Sunarto <andang99@gmail.com>**

[Fractal Fract] Manuscript ID: fractalfract-1290842 - Revised Version Received
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Andang Sunarto <andang99@gmail.com>   2 Agustus 2021 10.49
Kepada: eric.yan@mdpi.com

Greeting Prof Eric
Thank you for your infornation

Andang Sunarto
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[Kutipan teks disembunyikan]

Dear Reviewer 1,

We want to thank you for the careful and constructive reviews on our manuscript (**fractalfract-1290842**) entitled *"Quarter-sweep preconditioned relaxation method, algorithm and efficiency analysis for fractional mathematical equation"* for publication in Fractal and Fractional.

Based on your comments, we have made further changes to the manuscript, which are detailed below.

<u>Reply to the comments by Reviewer 1</u>

1. *Authors should improve the introduction by including the recent development within the frame of the numerical scheme in the Caputo fractional order sense and their illustrative applications with the help of recently published papers.*

Reply: Thank you for the comment. The introduction part of the manuscript has been revised accordingly by including several recent papers related to the frame of the numerical scheme in Caputo sense with their applications. Please see Page 2, Line 48-77.

2. *They should extend the concluding remarks section so that it provides and covers all the finding of the paper and future direction.*

Reply: Thank you for the comment. The conclusion part of the manuscript has been extended by highlighting the findings of the paper and future direction. Please see Page 13, Line 397 to Page 14, Line 419.

3. *What makes the proposed numerical scheme suitable for this unique task? What new development to the proposed method have the authors added (compared to the existing approaches)? These points should be clarified.*

Reply: Thank you for the comment. The above questions have been answered accordingly. Please see Page 2, Line 83-95.

Dear Reviewer 2,

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2.   *Give detailed explanations how equation (23) is obtained.*
3.   *Stability result should be established for the proposed method defined by equation (15).*
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Dear Dr. Sunarto,

Congratulations on the acceptance of your manuscript, and thank you for your
interest in submitting your work to Fractal Fract:

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