Accepted Manuscript

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PII: S0377-0427(18)30443-6
DOI: https://doi.org/10.1016/j.cam.2018.07.023
Reference: CAM 11809

To appear in: *Journal of Computational and Applied Mathematics*

Received date : 21 January 2018
Revised date : 10 June 2018

Please cite this article as: H. Yépez-Martínez, J.F. Gómez-Aguilar, A new modified definition of Caputo-Fabrizio fractional-order derivative and their applications to the Multi Step Homotopy Analysis Method (MHAM), *Journal of Computational and Applied Mathematics* (2018), https://doi.org/10.1016/j.cam.2018.07.023

A new modified definition of Caputo-Fabrizio fractional-order derivative and their applications to the Multi Step Homotopy Analysis Method (MHAM)

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In this paper, we present a new definition of fractional-order derivative with a smooth kernel based on the Caputo-Fabrizio fractional-order operator which takes into account some problems related with the conventional Caputo-Fabrizio factional-order derivative definition. The Modified-Caputo-Fabrizio fractional-order derivative here introduced present some advantages when some approximated analytical methods are applied to solve non-linear fractional differential equations. We consider two approximated analytical methods to find analytical solutions for this novel operator; the homotopy analysis method (HAM) and the multi step homotopy analysis method (MHAM). The results obtained suggest that the introduction of the Modified-Caputo-Fabrizio fractional-order derivative can be applied in the future to many different scenarios in fractional dynamics.

Keywords
Fractional calculus; Homotopy analysis method; Multi step homotopy analysis method; Modified-Caputo-Fabrizio derivative.