# Response to the comments of reviewers for Solving differential equations with global optimization techniques

## Reviewer 1

### 1.Comment

The logic of the writing is not clear enough kindly rewrite

### Response

We have changed the section 2 that describes the proposed methodology in order to be clearer for the reader and we have re – order the sequence of subsections. Thank you for this comment.

### 2. Comment

Relevant literature should be added to support the point of view in the paper: <https://doi.org/10.1007/s40009.019.00867.1;> <https://doi.org/10.1016/j.amc.2016.07.021> ; DOI: 10.3233/FI.2014.1084

### Response

The following references have been added:

**References**

1S. Effati, M. Pakdaman, Artificial neural network approach for solving fuzzy differential equations, Information Sciences **180,** pp. 1434-1457, 2010.

2M. Pakdaman, A. Ahmadian, S. Effati, S. Salahshour, D. Baleanu, Solving differential equations of fractional order using an optimization technique based on training artificial neural network, Applied Mathematics and Computation **293,** pp. 81-95, 2017.

3M. R. Admon, N. Senu, A. Ahmadian, Z. A. Majid, S. Salahshour, A new efficient algorithm based on feedforward neural network for solving differential equations of fractional order, Communications in Nonlinear Science and Numerical Simulation **117**, 106968, 2023.

Also a paragraph has been added to Introduction section with the following content:

*“Recently , Effati et al [*[*nn\_de\_similar1*](#LyXCite-nn_de_similar1)*] used artificial neural networks for solving differential equations. Also, Pakdaman et al [*[*nn\_de\_similar2*](#LyXCite-nn_de_similar2)*] used artificial neural networks to solve differential equations of fractional order. Furthermore, Admon et al proposed an algorithm based on artificial neural networks for solving differential equations of fractional order.”*

### 3. Comment

Check the symbols used by the formulas are not identified previously and some symbols confused kindly check and write clearly.

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### Response

1. Minor corrects have been done to the definitions of the error calculations.
2. Some symbols in the Genetic algorithm have changed to avoid confusions
3. We have corrected the symbols in PSO algorithm to be more consistent.

### 4. Comment

The innovation points of the paper are not prominent enough and need major revision

### Response

The following paragraph has been added in the introduction section

*“In the proposed methodology, the problem of numerically solving differential equations has been reduced to a machine learning model parameterization problem using global optimization techniques. Consequently, any global optimization method can be used to solve differential equations, even techniques with parallelization capabilities, such as Genetic Algorithms for example. This means that the proposed technique could also be used to solve difficult problems of differential equations, such as for example large systems of ordinary differential equations.”*

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## Reviewer 2

### 1.Comment

The article should be checked for typographical and grammar errors especially in the Introduction section

### Response

The revised version of the article has been thoroughly checked using ispell and grammar check (https://www.grammarcheck.net/editor/).

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### 2.Comment

There should more discussions on the experimental results. Each table and figure should be explained in detail.

### Response

We have added more discussion on every experimental table as well as for every figure in the experimental results subsection.

## Reviewer 3