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Study and comparison of approximate solutions of certain perturbed differential dynamic systems.

Tefaha Lejdel Ali , Safia Meftah, Lamine Nisse

Faculty of Exact Sciences, Echahid Hamma Lakhdar University of El Oued, Operator theory, EDP and applications laboratory

1-Summary

In recent years, large groups of specialists have tended to study approximate solutions to different types of problems, due to the difficulty of solving them (or even the impossibility), in particular non-linear problems.

In our study, we will be interested in certain disturbed problems resulting from the modeling of different physical phenomena.

We will study these approximate solutions from several different methods, then compare them to a few and find the best approximation. We will also try to compare them numerically.

So the questions which arise essentially are on the one hand on the validity of such an approximate solution (in order to have a realistic representation of the modeled phenomenon), and on the other hand on the order and the estimation of the error of approximation of the exact solution (to guarantee the best possible accuracy).

2-Keywords

Perturbations, asymptotic analysis, analytical approximation, integral and fractional derivative, differential equations, stability.

3-Thesis plan

As a first step, the candidate must conduct a bibliographic study, which will allow her to have a sufficient view of the methods and techniques of (non linear) analysis in this area of research.

Then, she would be interested in studying and comparing the approximate solutions of these differential systems according to the methods used.

In a next step, we will apply the same idea to some differential equations with delay systems and / or partial differential equations, and will also deal with some fractional differential equations.

4-Bibliographic references

- [1] K. Khalil, Nonlinear Systems. ISBN 13 :9780132280242. Macmillan Publishing Company, New York. (1995).

- [2] E Mickens, Oscillations in Planar Dynamic Systems. Series on Advances in Mathematics for Applied Sciences-Vol. 37. World Scientific Publishing Co. Pte. Ltd. (1996).

- [3] S. Meftah. A new approach to approximate solutions for nonlinear differential equation , J. IJMMS, Volume 2018, Article ID 5129502, 8 pages.