Kerrigan Research Minigrant Proposal

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Project start date: October 2016

Project end date: June 30, 2017

Title of Project: On Solving Nonlinear Ordinary Differential Equations Using Laplace Transform techniques

Description:

Laplace transformation provides a powerful means to solve linear ordinary differential equations (ODEs) in the time domain, by converting these ODEs into algebraic equations. These may then be solved and the results inverse transformed back into the time domain. Tables of Laplace transforms are available to facilitate this operation. In this research project, we intend to extend the Laplace transform concept to solve nonlinear initial-value problems for ODEs. We will focus on solving first and second order initial-value problems then generalize the method to nth-order initial-value problems. By using the Laplace transforms, the nonlinear initial-value problem is converted into the Volterra integral form. Then, we apply the successive approximation technique to obtain the solution. We will also extend the Laplace transform method to solve boundary value problems. According to our knowledge, this approach has never been investigated in the literature. Several examples will be presented to illustrate the use of the proposed techniques.

Purpose:

1. Review Laplace Transform techniques for linear ODEs
2. Research other methods for solving nonlinear ODEs
3. Extend the Laplace transform concept to solve nonlinear initial-value problems
4. Extend the Laplace transform concept to solve nonlinear boundary-value problems
5. Present several examples to illustrate the use of the proposed techniques.
6. Writing Final Report
7. Preparing results for publication.

Prerequisites: Strong background in differential equations.

Timeline:

Month	**Purpose Item**
October 2016 to December 2016	1,2
January 2017 to May 2017	3,5
April 2017 to June 2017	4,5
May 2017 to June 2017	6
July 2017	7 (Working on Publication)