Kerrigan Research Minigrant Proposal

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Project start date: February 1, 2019

Project end date: Jul 30, 2019

Title of Project: Laplace Transform techniques for solving nonlinear boundary-value problems

Description:

The Laplace transform method provides a powerful means to solve initial-value problems for ordinary differential equations (ODEs). The method consists of converting these ODEs into algebraic equations. These may then be solved algebraically for the Laplace transform of the solution. Finally, the inverse Laplace transform provided the solution in the time domain. Tables of Laplace transforms are available to facilitate these operations. In this undergraduate research project, we intend to extend the Laplace transform concept to solve nonlinear boundary-value problems for ODEs. We will focus on solving second-order linear and nonlinear two-point boundary-value problems then generalize the method to nth-order 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. Analytical methods for solving nonlinear ODEs
3. Extend the Laplace transform concept to solve linear boundary-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
March 2019 to April 2019	1,2
April 2019 to May 2019	3,5
May 2019 to June 2019	3,4,5,6
July 2019	7 (Working on Publication)
Fall 2019	Prepare FUSE proposal