Kerrigan Research Minigrant Proposal

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Project Start: January, 2018

Project End: June 30, 2018

Title of Project: Fourier series expansion methods for the heat and wave equations in two and three dimensions

Description: The Fourier series expansion method is an invaluable approach for solving partial differential equations, including the heat and wave equations. For homogeneous heat and wave equations, the solution can readily be found through separation of variables and then expansion of the solution in terms of the eigenfunctions. However, solutions to inhomogeneous heat and wave equations through Fourier series expansion methods are not readily available in the literature for two- and three-dimensional cases. In this project, we shall develop a general method of solution for the inhomogeneous heat and wave equations in two and three dimensions with inhomogeneous boundary and initial conditions. For the two-dimensional equations, the domains will be considered a square, circle, and annuli. For the three-dimensional equations, the domains will considered a cube and a sphere.

Purpose:

1. Review Fourier Series Expansion Methods for Homogeneous Heat and Wave Equations
2. Research Applications of Green's Functions to Inhomogeneous Heat and Wave Equations
3. Extend Fourier Series Expansion to Inhomogeneous 2D Heat Equation
4. Extend Fourier Series Expansion to Inhomogeneous 2D Wave Equation
5. Extend Fourier Series Expansion to Inhomogeneous 3D Heat Equation
6. Extend Fourier Series Expansion to Inhomogeneous 3D Wave Equation
7. Numerical Calculation Considerations for Solutions to Two- and Three-Dimensional Cases
8. Write Final Report
9. Prepare Report for Publication

Timeline:

Month	**Purpose Item**
January,February	1,2
March	3,5
April	4,6
May	7,8
June	9