Abstract

The aim of this thesis is to investigate various aspects of the heat equation. We first consider the derivation of the heat equation and relevant historical background. Thereafter, we explore the Fourier series solution to the heat equation in terms of the method of *separation of variables*. The analysis of the solutions to the heat equation are examined in light of two of their properties; that is to say, uniqueness and existence. Furthermore, the thesis treats two boundary conditions; namely, the homogeneous and inhomogeneous Neumann boundary condition and Dirichlet boundary condition for the homogeneous heat equation; with a focus on the latter. Finally, the thesis studies the finite or bounded domains in which we assume $a < x < b$ that is scaled to $0 < x < 2\pi$ in a one dimensional space where $x \in \mathbb{R}$ of an idealized, homogeneous rod that is infinitely thin.

Keywords: heat equation, Fourier series, partial differential equations, diffusion, separation of variables.