

## **ABSTRACT**

A Spectral element method is proposed for the solution of Poisson's problem defined in rectangularly decomposable domains. In this method the domain is broken into two subdomains. The trial functions to be chosen are the eigenfunctions of the differential operator in each subdomain. The coefficients of series expansions are then determined by matching the solution and one of its derivatives across the contiguous domains using the Galerkin and the Collocation formulations. The thesis is summarized as follows:

Chapter 1 contains a brief review of partial differential equations and numerical techniques for their solutions. A description of some of the properties of Fourier Series and eigenfunctions expansions is given.

Chapter 2 comprises the fundamentals of spectral method with a brief introduction of its various versions. A review of the research work performed in this area is also provided.

Chapter 3 consists of implementation of spectral element method for the solution of Poisson's equation in the  $(1:\alpha)$  contraction geometry. The domain is divided into two semi-infinite rectangular regions and the solution in each region is expressed in terms of Sine Fourier Series in such a way that the boundary conditions are automatically satisfied. The coefficients of expansions are determined by matching the solutions and one of its derivatives in regions across their common interface. The Galerkin and Collocation formulations of matching conditions have been used. The matching process produces an infinite system of algebraic equations for the unknown expansion coefficients.