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 three subdomains. The trail functions to be chosen are the eigenfunctions of the differential operator in each subdomain. The coefficient 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 development of PDEs through different ages, introduction to compotation of solution PDEs Numerical Analysis and Computational Science, contain the 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 ⌋-Shape geometry. The domain is divided into three 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 of matching conditions have been used. The matching process produces an infinite system of algebraic equations for the unknown expansion coefficients.

Two examples have been discussed in chapter 4. The effectiveness of Eigenfunctions Expansions in achieving exponential convergence has been confirmed by using both Galerkin of matching conditions to determine the unknown coefficients. We conclude this study with some closing remarks.