CHAPTER II
LITERATURE SURVEY

Kolar (1997) presented a Reaction-Diffusion Equation Solver which was programmed in Microsoft C and uses Newman's method based on banded matrices and the Newton-Raphson method. He adopted this approach to the solution of arbitrary systems of coupled, nonlinear, parabolic partial-differential equations in two independent variables (time and one spatial variable), and presented a C package called TRANSIENT that could be easily applied to a large variety of such problems. TRANSIENT uses a general implicit finite difference scheme.

Machura and Roland (1980) presented a paper which contained a survey of the past and current software developments in the field of partial differential equations. Software tools aimed at reducing the task of solving partial differential equations were subdivided into five classes. Though attempting to give a broad overview of the field, the survey was biased toward general-purpose software, and the main emphasis was laid on two important classes of partial differential equation software, program packages with a high-level programming language interface and program packages with a special language interface.

Berzins *et al.* (1989) used the method of lines which is one of the most powerful tools for the solution of time-dependent coupled ODE/PDE systems. The attraction of this method is that the complex systems of coupled ordinary and partial differential equations arising in mathematical modeling can be solved by using sophisticated software which has been developed for initial value differential-algebraic equations. These components together with utility routines for spatial remeshing and discontinuity detection form an open-ended tool-kit for the method of lines.

Ma *et al.* (1992) presented the elliptic energy equation for steady, two dimensional incompressible flow over a flat plate with an unheated starting length which was analyzed by using matched asymptotic expansions where the boundary layer solution had been treated as the outer expansion corresponding to the leading edge of the heated part of the plate. This new technique for solving elliptic-to-parabolic equations involved stretching two different scales for two independent variables in the inner expansion. Results were applicable to the region where boundary layer theory breaks down, which was particularly interesting in microscale heat transfer.

Odeh (1996) presented a numerical methods package for solving partial differential equations of elliptic, parabolic and hyperbolic types in C. All numerical methods used were of an iterative nature to take advantage of the sparse and diagonally dominant matrices that result when solving the PDEs by finite difference method.

Eichler-Liebenow *et al.* (1997) used linearly implicit splitting methods for higher-space-dimensional parabolic differential equations. Splitting methods were recognized as useful tools in the numerical solution of initial boundary value problems of multi (space)-dimensional partial differential equations. Following the method of lines, they introduced a new class of linearly implicit splitting methods for the numerical solution of ordinary differential equations of the systems arising from the semidiscretization in space of a parabolic differential equation. The linearly implicit splitting formulas directly involved approximations to the Jacobian matrices in the scheme so that only linear equation systems with simple coefficient matrices were solved.