CHAPTER I

INTRODUCTION

Many problem encountered in scientific or engineering endeavors require the solution of mathematical equations or sets of equations which in most cases are difficult and in other instances are, for all practical purposes, impossible to obtain by the mathematical approach. Although solutions can be found we have to plot curves in order to see their shapes and their real characteristics. Complicated problems can be solved rapidly by an analogue computer. The output of the computer is the solution which can be recorded on an xy-ploter or observed on an oscillograph. Although the analogue computer utilizes electronic components and electrical circuit characteristics in its operation, it is not essential for the user to have an extensive knowledge of electrical circuits. The task of setting up the correct electrical model on the computer is simple, and the steps necessary for accomplishing this task once the mathematical description of the primary system is known will be described later in this thesis.

The purpose of this thesis is to show how to find the solutions of some problems in Quantum Mechanics by using the analogue computer, in particular in solving the Schrödinger wave equation for various one-dimensional potential fields, such as that for the free particle, for the motion of a

particle in a constant potential, and at a potential step; also for the penetration of a potential barrier by a particle, and for the binding of a particle into a narrow region by a square-well potential.

Though Schrödinger's equation in one-dimension is an ordinary differential equation, in three-dimensions it is a partial differential equation. Solving these equations is not simple when we have to find the energy eigenvalues for general potential fields. In this thesis methods for solving the Schrödinger wave equation in various forms by the Heath Analogue Computer are described.

First it is necessary to give a brief review of the operation of the computer and also an outline of the Schrödinger equation. These topics form the subject matter of the next two chapters.