CHAPTER I

INTRODUCTION

Motion planning is an increasingly important field of research. Factory automation is becoming more prevalent and at the same time, production runs are shortening in the name of customization. With computer controlled equipment becoming cheaper and more modular, setting up near-fully automated production lines is becoming fast and easy. This means that the actual programming of the robots and assembly system is becoming the rate determining step. Automated motion planning is a possible solution to this—but only if it can run fast enough.

Hence, there is a great need for motion planning approaches that consider simultaneously both the optimization of the general trajectory and its conformity to any desired practical constraints. In addition, these approaches must be computationally efficient to be applicable in practical situation. Network approaches and Genetic Algorithms are among these approaches.

1.1 Problem Description

In its most general form, the motion planning problem is stated as follows: [1] Given a system of objects, a start and a goal configurations for these objects, and a set of obstacles which can be stationary or moving with known patterns, the objective is to find the best feasible trajectory for the system of objects to move from the start configuration to the goal configuration such that collision with the obstacles is avoided.

Different versions of this problem correspond to the cases where the obstacles are stationary or moving, and where the system of objects consists of point, a single polygonal object, a single polyhedral object, or a set of polygonal or polyhedral objects. This problem is faced, for example in robot based assembly without collision with the neighboring objects or other robots, inside dangerous places such as reactors, hot rooms and greenhouse and aircraft routing.

1.2 Thesis Outline

The thesis comprises seven chapters.

Chapter 1: Gives an introduction to the subject of the thesis.

Chapter 2: Describes various approaches of motion planning and the objective of this thesis.

Chapter 3: Is an overview of Genetic Algorithm. It begins with a detailed description of genetic algorithm, including GA operators, how does GA works. It is also described some previous work related to random number generator is surveyed.

Chapter 4: Presents the hardware implementation. Every cell of the genetic operators is implemented and simulated. Systolic arrays are composed from those cells into the different modules of the GA system. This means the selection module (roulette wheel selection), crossover module the mutation module and the random number generators are described in hardware using VHDL and VHDL models are simulated to check for functionality and performance.

Chapter 5: Discusses problem of population sizing and fitness evaluation. For every path of the population generated, we assign fitness value calculated (using a simple program).

Chapter 6: Shows syntheses of the proposed genetic operators arrays and implementation results and discussion.

Finally, **Chapter 7**: Concludes this thesis with short summary and possible important notes for the continuity of the research in this subject.