CHAPTER 1

INTRODUCTION

1.1 SCHEDULING

Scheduling is concerned with allocating limited resources to tasks to optimize certain objective functions. One of the most popular models in scheduling is that of the job-shop. The classic job-shop scheduling problem (JSSP) can be described as follows: a set of m machines and a set of n jobs are given. Each job consists of a sequence of operations that must be executed in a specified order. Each operation has to be performed on a given machine for a given time. A schedule is an allocation of operations on machines in time, i.e. a sequence of operations on machines. The problem is to find the schedule so that the make span (the maximum of job completion times) or other cost function is minimal, subject to the following constraints: (i) the operation precedence constraints are respected for every job; (ii) each machine can process at most one operation at a time; and (iii) an operation cannot be interrupted if it initiates processing on a given machine.

The assembly job shop scheduling problems (AJSSP) are one of the most difficult problems, as it is classified as a non deterministic polynomial (NP)-hard type. The combinatorial search space increases exponentially with increase in resources, and thus the generation of consistently good schedule is particularly difficult. Exact methods such as the dynamic programming, branch and bound take considerable computing time provided that an optimum solution
exists. In order to overcome this difficulty, it is more sensible to obtain a good solution which is near-optimal. Search techniques such as PSO and GA are able to lead to our objective i.e., to find near-optimal solutions for a wide range of combinatorial optimization problems.

Scheduling an assembly job shop requires proper coordination of flow of materials through the various stages necessary to complete a product. Consequently, assembly job shop scheduling is a much more complex problem than that of scheduling a single-state job shop.

The assembly job shop consists of seven work centers and an assembly station. In the present study, optimum solutions that give minimum lead time and tardiness have been found out using PSO and GA. The optimum solution is the set of job order sequences for each work centers that give that give minimum objective function.

To find the parameters of PSO and GA that give optimum solutions in the aim of reducing the computational time, experiments are conducted with three types of jobs and two due date settings. The parameters that give optimal solutions consistently have been taken as optimum.

Objectives such as minimization of mean lead time, and mean tardiness have been considered. Models of multi-level assembly job shops applying PSO and GA are developed in ARENA 10.0. Comparison is done between the results of the performance measures obtained from PSO and GA and the results of some priority dispatching rules.

The results of PSO and GA are compared with some selected PDRs to find out their effectiveness in producing optimal solutions in comparison with PDRs.
1.2 OUTLINE OF THE STUDY

Chapter 2 gives a survey of literature that deals with job shop and assembly job shop scheduling using PDRs, PSO and GA.

Chapter 3 describes in detail PSO and GA. The basic concepts and detailed description of PSO are discussed in this chapter. The important parameters of PSO and their influence in arriving at optimal solutions are explained. Similarly for GA the basic principles and important operators of GA and their influence in searching for optimal solutions are explained.

Description of the existing popular priority dispatching rules considered for the purpose of comparison with PSO and GA are given in chapter 4.

In chapter 5, detailed description of the simulation model of a hypothetical assembly job shop, different job structures considered, the process of collecting data for analysis are given.

In chapter 6 the experimental setup is described in detail. The experimental setup consists of a) the simulation model of the hypothetical assembly job shop described in chapter 5, b) different types of job structures considered and their configuration and c) the assumptions followed in the study.

Chapter 7 deals with analysis of the results. From the results obtained, the optimum sequences that give minimum lead time and minimum tardiness, the corresponding parameters of PSO and GA, the effectiveness of PSO and GA in finding the optimal solutions in comparison with PDRs are discussed.

Conclusion and scope for further study is provided in chapter 8.