ABSTRACT

In the modern competitive environment in manufacturing and service industries, the effective sequencing and scheduling have become essential for continuous existence in the marketplace. Companies have to produce their product untimely as opposed to due date. Otherwise, it will interrupt upon reputation of a business. At the same time, the activities and operations need to be scheduled with the intention that the available resources will be used in an efficient manner. Scheduling is an intellectual and skilled process of finding the optimal resources for processing of different activities. The main goal of a good schedule is to overcome heterogeneous computing resources, minimize overall performance such as high resource utilization rate and to support various computing intensive applications involving batch jobs and parallel activities. The resources are wisely chosen based on their availability and capacity. Main challenges are faced in scheduling of tasks to the best available resources. To attain an effectual and operative scheduling, effective new algorithms are essential. Researchers have done many experiments on scheduling and created great good scheduling algorithms. As per the results given by the researchers, the traditional available scheduling algorithms provide unfeasible solution whereas heuristic approaches are
providing optimal and feasible solutions. Most of the prevailing practical scheduling problems exist in stochastic and dynamic environment.

The meta-heuristic search methods are used for solving general computation problems by combining the given procedures to obtain efficient and robust procedure. The search optimization techniques like Ant Colony Optimization, Particle Swarm Optimization, Genetic Algorithm, Simulated Annealing and Evolutionary Algorithms are used and implemented by the researchers for solving scheduling problems.

The main objective in solving the Job Shop Scheduling Problem (JSSP) is to find the sequence for each operation on each machine that optimizes the objective function. The most common objective function that has been used in scheduling the JSSP is minimization of makespan value or to find out the reduced time for completion of all jobs.

This thesis proposes two different heuristic techniques to solve the Job Shop Scheduling Problem. After studying the strengths and weaknesses of previous methods, new stochastic algorithms are proposed for solving JSSP. In this research, SA-GA Hybrid and Random Top n-Mean Based Stochastic algorithms are developed for solving JSSP and will evaluate the performance with different activities.

Even though, Genetic Algorithm (GA) may perform better than other evolutionary algorithms, it has some weakness. Due to poorly known
fitness functions which generate bad chromosome blocks inspite of the fact that only good chromosome blocks cross-over, there is no absolute assurance that a genetic algorithm will find a global optimum and the genetic algorithm cannot assure constant optimization response times. During the execution of GA, in some generations, it will produce the same result without any improvement. GA does not have any mechanism to overcome this situation. Even though Simulated Annealing (SA) performs worse than GA, it has a mechanism to overcome the weaknesses of GA. During the execution of SA, if same result is repeated, then it will rapidly alter the change in temperature variable and re-initiates another random search. By using this feature of SA, this has been implemented as a hybrid based evolutionary model for solving JSSP by improving GA. Comparison is made with the performance of the proposed SA-GA-Hybrid with GA, SA and Particle Swarm Optimization (PSO).

The Evolutionary techniques will find optimum solution in each step and will derive more results by the perturbation of that optimum solution. In this proposed algorithm, n top best optimum solutions are selected and will find a mean value of that n solution and then derive new solutions based on it. Comparison of the performance of the RTN-mean based model is made with GA, PSO and SA based models.

SA-GA-Hybrid and RTN-Mean techniques have been implemented for solving JSSP and evaluated their performances have been evaluated.
Comparison has been made with the results of RTN-Mean and SA-GA-Hybrid with GA, PSO and SA based models. It is observed that the new SA-GA-Hybrid model’s performance is better than GA, PSO, SA and RTN-Mean model. The arrived results show that the proposed models produced optimal or near-optimal solutions medium level job shop scheduling problems in a short duration. The speed of proposed RTN-Mean method has almost equal to PSO and produced optimum results better than PSO and SA.

While initializing with known, worst case solution, the evolutionary process was capable of converging into meaningful and more optimum solutions. The time taken for the proposed RTN-Mean algorithm has lesser than even GA but GA produced better results with high dimensional JSSP problems. SA-GA-Hybrid model performed better than GA and produced better results at almost same run time of GA.

By means of results it has been observed from the convergence curves, the above mentioned heuristics approaches provide successful results. Thus these techniques produced significant percentage of reduction in the makespan time.