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LITERATURE REVIEW FOR SCHEDULING PROBLEMS

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Abstract – ***Present study in the paper is concerned with the development of new genetic operators to optimize the performance of the system. To improve the production facilities, a set of jobs are executed on the set of machines. For better performance there are large numbers of constraints. Process scheduling theory has been developed to meet all side constraints. Process Schedule is done in such a way that the resulting solution minimizes the given objective function. Many variants of the basic scheduling problem can be formulated by differentiating between machine environments, side constraints and objective functions. Genetic algorithm have been applied to OSPSP. The study shows that proposed operators shows better results***

Keywords- Genetic Algorithm,Meta heuristic,Scheduling,Optimization.

HISTORICAL BACKGROUND

To improve the production facilities, a set of jobs are executed on the set of machines. For better performance there are large numbers of constraints. Process scheduling theory has been developed to meet all side constraints. Process Schedule is done in such a way that the resulting solution minimizes the given objective function. Many variants of the basic scheduling problem can be formulated by differentiating between machine environments, side constraints and objective functions. Until late 1980s, it was common practice that in the objective function only one performance criteria was taken into account. In practice, quality is a multidimensional notion.

LITERATURE REVIEW

Hanssmann and W.Hess (1960) They used Linear Programming (LP). LP is a mathematical method for determining a way to achieve the best outcome like maximum profit or lowest cost in a given model. LP is a specific case of mathematical optimization.

Held and Karp (1962) have applied Dynamic Programming (DP) as an implicit enumerative search method. This can be seen as a kind of divide and conquer technique. In order to solve a large problem, decompose it into several small independent sub problems. Solve all the small sub problems and keep them for later use.

Ignall and Schrage (1965) developed branch and bound algorithms for the permutation flow shop problem with make span minimization.

Bomberger (1966) presented DP approach to lot scheduling problem. He considers the production scheduling of different items over the same facility on a repetitive basis. The facility in the system is such that only one item can be produced and process at a time. The item produced is associated with setup cost and setup time. The demand rate for every item is known and it will be constant over an infinite planning horizon.

All demand must be met.

Campbell *et. al.*, (1970) applied heuristic algorithm in stages.

Lockett and Muhlemann ,(1972) used branch and bound algorithm for scheduling jobs with sequence dependent setup times on a single processor to minimize the total number of tool changes. The algorithm was restrictive computationally and suitable only for the small sized problems.

Crowin and Esogbue (1974) considered the two different flow shop scheduling problems. These arise when, in a two machine problem, one machine is characterized by sequence dependent setup times. The objective is to determine a schedule that minimizes make span. After establishing the optimally of permutation schedules for both of these problems, an efficient DP formulation is developed for each of them.

GA based algorithms are inspired by Darwin's theory of "Natural selection and survival of the fittest". These were invented by Holland, (1975).

Rinnooy Kan (1976) indicates "a natural way to attack scheduling problems is to formulate them as mathematical programming models". The results found was not satisfactory. The majority of these techniques are unable to achieve feasible solutions to many problems. Therefore, these methods are of limited practical use.

Panwalkar *et. al.*,(1977) gives a detailed explanation of some of these dispatching rules.

Tripathy (1980), Arani et al., (1988), Sadykov and A. Wolsey, (2006) have applied IP on vehicle scheduling problem. The results were better.

Gupta ,(1982), (1986) used a mathematical model based on the branch and bound technique to solve static scheduling problems involving n jobs and m machines for minimizing the cost of Machine setting . He assumed that

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sets up times were sequence dependent. It is not included in processing times. The algorithm was only used to solve small size problems. It provided an insight into the structure of optimal solutions. These could be used to devise good heuristic rules. Heuristic rules are generally more appropriate to solve large size scheduling problems where computational efforts increase rapidly with problem size for optimizing techniques.

Kirkpatrick et al.,(1983) applied SA to combinatorial optimization problems.

Hundal *et. al.*,(1988) used heuristic algorithm for the flow shop scheduling problem.

McCormick *et. al.* , (1989) used a Profile Fitting (PF) heuristic algorithm. It is based on the departure times of the jobs computed after each job has been scheduled.

Goldberg,(1989) used GAs for scheduling problems. In GA based approach, the various stages like evaluation, selection, crossover and mutation are repeatedly executed after initialization until a stopping criterion is met. The algorithm works on multiple solutions simultaneously.

Taillard ,(1990) showed that random pair wise swapping is computationally more expensive compared to random insertion method. He showed experimentally that random pair wise swapping does not yield a better convergence to the optimal solution than the random insertion method.

Beck *et al.(19*91) Berry *et at.(19*93) used constructive techniques called, " ***"Knowledge based or AI-based"*** systems.

Rajendran and Chaudhuri , (1992) used a heuristic algorithm to minimize flow time for a flow shop scheduling problem. It uses three heuristic criteria. (i) It deals with the sum of idle times. (ii) It incorporates the sum of idle times and the waiting times. (iii) It includes the completion times of the partial schedule at various stages.

Taillard,(1993) used Ant Colony Optimization Algorithms (ACOA) to evaluate upper bound values for make span factor.

Zegordi *et al.*,(1995) showed that a good set of parameters can result in much quicker convergence to the optimal solution.

Marett and Wright,(1996) compared the performance of TS algorithm and SA algorithm for multi objective flow shop scheduling problems. They found that results obtained by using SA algorithm were better than TS algorithm.

Pan and Fan, (1997) used branch and bound algorithm for the same problem. They used dominance properties to reduce the size of the problem. The algorithm was able to solve all the problems up to 18 jobs.

Chen *et al.*,(1998) applied DP approach to relaxation problem of scheduling . It concerns the use of Lagrangean relaxation for complex scheduling problems. Optimal solution has been found for single and parallel machine problem by using this technique. It consists of relaxing capacity constraints using Lagrange multipliers. The relaxed problem can be decomposed into independent job level sub problems.

Voss et. al. ,(1999) used a metheuristic algorithm as "Iterative master processes that guides and modifies the operations of subordinate heuristics to efficiently produce high quality solutions".

De Castro and Timmis,(2003) used Artificial Immune System (AIS) Algorithm. AIS is an adaptive heuristic technique inspired by the human immune system. The two integral aspects in the immune response mechanism are; (i) colonel selection principle and (ii) affinity maturation.

Engin and Doyen,(2004) used an AIS based heuristic for hybrid flow shops. They applied their algorithm to the benchmark problems for hybrid flow shops. This algorithm performs better than Branch and Bound algorithms.

Rajendran and Ziegler,(2005) used two ACOAs to minimize the total flow time in permutation flow shops. The algorithms generate an initial seed sequence. It also carries out a local search at the end of each iteration.

Noorul Haq and Radha Ramanan, (2006) used ANN to minimize bi criteria of make span and total flow time in flow shop scheduling environment. They showed that ANN achieves a solution quality better to that of traditional heuristics or at least comparable to it. They concluded that ANN incrementally improves the solution quality with the increase in numbers of training exemplars.

Chakraborty and Laha ,(2007) used NEH algorithm for make span minimization problem in permutation flow shop scheduling. Their computational study revealed the significant improvement in the quality of the solution while maintaining the same algorithmic complexity.

Naderi *et. al.*,(2009) used SA algorithm for hybrid flow shop scheduling problem to minimize total completion time and total tardiness including sequence dependent set up. Their algorithms had the superiority over other SA algorithm.

Eren ,(2010) used a bi criteria *m*-machine flow shop scheduling problem with sequence dependent setup times with minimization of the weighted sum of total completion time and make span. He used the special heuristics algorithm for fitness function considered. He proved that the special heuristic for all number of jobs and machines was more effective.

CONCLUSION

Hence, it is concluded from literature that to study the behaviour of GA under OSPS has becoming interesting preference for the researcher. Development of new genetic operators is still the major issues related to the scheduling problem.

Therefore, in the existing work, it is observed that researcher are merely applied GA with the mixing of other local search. But they not concentrate on the proper parameter setting of the GA. The performance of the GA depends upon its genetic operators and parameter setting used. An attempt has been made to develop new genetic operators for the scheduling problem and analyze the optimal parameter setting of the GA for scheduling problem

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