CHAPTER 11

CONCLUSION AND SCOPE FOR FUTURE RESEARCH

11.1 CONCLUSIONS

This thesis has focused on scheduling problems that arise in Flexible Manufacturing Systems. In this work, a more generalized FMS scheduling problem is modeled and different intelligent search heuristic procedures are developed to approximately solve the FMS scheduling problem.

In the GA based search heuristic (GASH) developed, two different coding schemes (binary and pheno style codifications) are experimented and it is found that the binary codification is better in terms of computational time required and the ease of computer programming. In order to improve the searching ability of the GA, different Secondary Population Implementation Schemes are developed and applied to the GA based heuristic method. Out of all the schemes, SPI-6 is found to be more effective. To speed up the search process, two different parallelization schemes (Homogeneous and Heterogeneous parallelization models) are developed for the GA based heuristic procedure. The experimentation result reveals that Homogeneous Parallelization scheme introduced in this work is consistent and effective.

In the SAA based search heuristic (SAASH) developed for scheduling FMS, a dynamic variation in the neighborhood construction mechanism is introduced, which exhibited its superiority over the standard SA template.

In the TS based search heuristic (TASSH) developed for scheduling FMS, advanced features such as Long Term Memory, Critical Event Memory and Restarting Mechanism are incorporated and its performance is better than that of the basic TS algorithm.
In the SS based search heuristic (SCASSH) developed for scheduling FMS, advanced design features viz., Reference Set rebuilding, Dynamic Reference Set updation and Tabu Memory implementation are incorporated whose performance is found to be much better than the standard SS algorithm.

The performance of all the intelligent heuristics are compared with that of a few priority dispatch rules commonly employed in practice, such as SPT, LPT, LBQ, SBQ, EDD, and HP. It is found that the performances of all the developed heuristics are better than these pdrs. From the comparison of the result, it is concluded that the advanced SS based heuristic (SCASSH) is more efficient than all the other heuristics with respect to the FMS model and the problem environment considered in this work.

In this thesis experiments have been conducted on the specific problem instances, that is, example FMS environment, whose configuration (with parameters \( m = 16, g = 5, z = 2, r = 1 \) to \( 3 \) and \( n = 40 \) to \( 50 \)) matches with general FMS model described in chapter 3, to solve the scheduling optimization problem addressed in section 3.2.5 of chapter 3. To validate the result, a few bench mark FMS layouts (whose configuration also matches with the general FMS model described in chapter 3) and job sets taken from the literature are experimented with all the developed heuristics for a different objective criterion. The result of experiments has ascertained the conclusion that the SS based intelligent search heuristic outperforms all the other heuristics developed in this work and found in the literature. Hence, it is firmly concluded that the proposed intelligent search heuristic (SCASSH) can be successfully applied to any kind of FMS configuration and problem environment for generating nearer-to-optimal solution with any scheduling objective criterion.
11.2 SCOPE FOR FUTURE RESEARCH

The outcome of this research work has revealed much scope in the Flexible Manufacturing scenario, in aspects as outlined below:

1. The GA based heuristic procedure can be further fine tuned with multiple parallel populations' methodology to further aggravate the search process.

2. The possibility of developing hybrid algorithms by combining the GA, SA and TS based procedures to overcome the shortcoming of the individual methodology.

3. The possibility of incorporating the advanced TS memory strategies in the Scatter Search methodology to further improve its performance.