CHAPTER 7

General Conclusion and Scope for Future Work

7.1 General Conclusion

Remaining within the various existing constraints, the researcher has made an effort to study the various machining processes and their control parameters. Further, attempts have been made to explore the techniques for optimization of processes.

Thus, from this research study, the researcher has drawn the following conclusions;

(i) From the literature survey, machining processes are broadly classified as traditional machining, nontraditional machining and micro-machining. Traditional machining use conventional cutting tools and constant contact between the cutting tool and the workpiece is maintained during machining. This type of machining is broadly used for all types of cutting and drilling holes. Non-traditional machining uses other energy sources such as electric, chemical and thermal etc. They provide an excellent alternative to traditional machining while cutting high strength to weight ratio materials. As there is no contact between the cutting tool and the workpiece, hence there is no mechanical stress development in the workpiece due to the cutting tool. Micro-machining is basically concerned for miniature works and where precision is the prime objective.
(ii) As experimental methods are cumbersome and at times not feasible, a search for an efficient soft computing technique is carried out. Curse of dimensionality and a local optimal trap which are major hindrances in mathematical programming methods are simultaneously overcome by GA. Further, GA is adopted as the soft computing technique to provide the necessary combination of control parameters in order to optimize the desired responses.

(iii) Machining parameter constraints such as the range of operation of various control parameters are accommodated in the optimization technique. Selection of parameters of complex machined parts that require many machining constraints, can be easily done using the GA technique.

(iv) The modified GA equipped with an elitist technique for evolution used in this research work is found to be robust in providing optimum solution within a reasonable computation time and yield better solutions. The average prediction error of GA predicted results when compared to experimental results is less than 4% for all the single objective responses considered in this research. Hence, the results show the viability of use of GA for optimization of machining processes.

(v) The results obtained by the proposed GA technique provided through this research work shows GA outperform RSM and other optimization techniques with varying difference in computational efficiency when used to solve problems associated with the optimization of machining processes. The accuracy and superiority of GA predicted results compared to RSM predicted show the effectiveness of GA.

(vii) A chart is prepared which records the possible combination of control parameters for optimal responses. This provides an initial guiding tool for the operators while
selecting correct control parameter combination to get the optimized responses as mentioned in the chart.

(viii) GA is applied to optimize different responses considering CNC drilling as a traditional, ECDM & LBM as non-traditional and micro-EDM as micro machining processes. An elitist technique for population generation and an artificial initial population scheme incorporated in this improved GA prove to be a faster search mechanism. The proposed GA used for multiobjective optimization is based on NSGA-II. This modified GA helps to efficiently search and actively explore the solution points. The pareto optimal solution obtained in this research can be used as a practical optimization tool for a real problem like operation of machining processes. Moreover, the proposed GA approach is a simple concept with easy implementation yet better effectiveness than other optimization techniques.

(x) This GA approach can be useful at the computer-aided process planning stage. With the known boundaries of response and machining conditions, machining can be performed with a relatively high rate of success with the selected machining conditions.

(xi) The application potential of the optimization results obtained from the present approach can be integrated on-line with an intelligent manufacturing system for automated process planning. Integration of this GA optimization approach with an intelligent manufacturing system will lead to reduction in production cost, reduction in production time, flexibility in machining parameter selection, and improvement of product quality.
7.2 Scope for Future Work

(i) This research does provide some directions for future work. The application of GA based approach in complex as well as flexible machining systems and automated process planning-systems is one such avenue for future research work.

(ii) The work done in this research is expandable. Further research work could include the effect of more parameters which will give better control over the desired response.

(iii) Based on the Web-based GA optimization program, a Web-based database of control parameters selection as well as work material selection can be developed by using Database Management System (DBMS). This DBMS may also store a knowledge database of cutting conditions and machining performance measures.

The researcher genuinely hopes that this research study will give an insight to the other researchers, academia and industry personnel to easily utilize the modular outcomes of this research work to solve their problems.