ABSTRACT

The uncertainties regarding the capabilities of Non-Traditional Machining Processes (NTMPs), the large number of NTMPs offered, the lack of versatility and the shortage of experienced design engineers in the field of NTMPs necessitate the development of a structured process selection procedure. Moreover, the abundance of available and emerging selection procedures for NTMPs has confused the design engineers in selecting the appropriate NTMPs. The need to select the appropriate NTMPs has become inevitable for survival of the manufacturing companies dealing with NTMPs.

In this thesis, a Web - Enabled Knowledge Base System (WEKBS) is presented to help manufacturing personnel in determining the most suitable NTMPs for a given application problem. The selection procedure first enables the user to access the knowledge base system through the Internet in order to feed the limiting requirements (www.selectntm.com). Then, the procedure ranks the feasible NTMPs according to their suitability for the desired application and finally, it display the most suitable NTMPs through online dynamically.

The selection procedure uses multi-attribute SQL - based queries with knowledge base for ranking the feasible alternatives and selecting the most suitable NTMPs. The thesis discusses the evolution of the research concept, identifies NTMPs of industrial importance, research objectives, and
validates the research concepts with real life case studies. Exhaustive reviews of selected NTMPs and Hybrid Non-Traditional Machining Processes (HNTMPs) have also been done. The model evolved out of this research – Design and Development of Web - Enabled Knowledge Base System for Selection of Appropriate Non-Traditional Machining Processes – is a holistic model for selection of most suitable NTMPs. This computer aided tool helps the user to analyze the possible alternatives lucidly and objectively. Based on this model any company dealing with NTMPs can choose the appropriate NTMPs that suit it best for a given application problem.

This research study has given a holistic approach to select the appropriate NTMPs for excellence in process selection. The major contributions of this research are: Helping the design engineers in selecting the most suitable NTMPs for the problem at hand through ‘Selection module’, Dealing with very large data and responding quickly using ‘Expert module’, Standardising the conclusion for a given set of data related to NTMPs, Capturing the scarce expertise on NTMPs and making it available for effective use, Provision for combining the knowledge of several people who are physically separated but geographically well connected through Internet, multi-attribute SQL - based queries with knowledge base, weighted property indices based grade calculations, and Interactive selection of process parameters.

The software by helping the design engineer will show its impact on the excellence in selection of NTMPs. This software is also made versatile for global application. For use in the selection procedure, Material
Applications, possible Shape Applications, Process Capability attributes necessary to measure the performance of various NTMPs are considered. Many industrial case studies (more than 25) are introduced to examine the dependability of the developed approach, and successful results are obtained. The system developed provides appropriate selection of NTMPs which matches practice in industry. The final choice among the candidate NTMPs will be judged by design engineers based on cost and availability.

The data related to NTMPs can be centralized with the approach described in this research work. The data can be stored in one of the web servers, which allows the user to access through the Internet. This means it is accessible throughout the world. The bulky data hand books need not be carried all over the place. The data related to NTMPs can be stored and maintained at any one site by some standard organizations. Users can access the most up-to-date data easily throughout the world and even benefit from any minor change in the data. Another important feature is platform independence. The client side can be of any platform to access the server information.

The present web-enabled knowledge base system has been uploaded on www.selectntm.com for the users to access the system and perform the selection of most suitable NTMPs for a given machining problem. Provision is also made for administrator to access and modify the knowledge base through login window on www.selectntm.com/admin, by inputting the proper user Id and password.
The present research can be extended to selection of Hybrid Non-Traditional Machining Processes and Micromachining Processes as well. The expert system used can be upgraded to hybrid expert system so that process characteristic curves can also be fed as input to the system and accurate selection can be made. A separate expert module can be introduced into the WEKBS so that experts who are physically separated but well connected geographically through the Internet can access the knowledge base, update, and share the common knowledge bank for selection thereby up-to-date and accurate selection of NTMPs can be made possible.

The NTMPs can be modeled based on Metal Removal Rate (MRR) and Surface Finish using neural network approach and the selection of NTMPs can be done using the developed models. The WEKBS can be used as a guiding tool for the young entrepreneurs, engineers and technocrats involved in decision making process.

The present research can be extended by including certain important selection parameters such as machining time, machining cost, metal removal rate, and environmental factors of NTMPs in the selection procedure so that a more realistic selection of NTMPs can be made. The proposed WEKBS has tremendous potential to make it a commercial package.