ABSTRACT

Miniaturization of product plays an important role for technological development in the field of aerospace, automobile, bio medical, semi conductor industries, etc. Micromachining is the key technology for the realization of miniaturized products with augmented number of functions. Micro machine tools are capable enough to produce precision parts with desired accuracy, but deficient in decision making. It purely depends on expertise skill and inconsistent in nature. Hence, the development of decision support system for manufacturing planning in micromachining needs research attention.

Process planning using computer is an effective approach to automate the range of decision required to convert the raw material into finished parts. In this research work, an effort has been made to develop Intelligent Process Planning System (IPPS) for conventional tool based micromachining processes. DT110 Multi process micromachining centre capability is considered for the investigation. Micro turning, micro drilling and end milling processes are taken into account. IPPS development activities comprise of four essential elements; it includes 1.Data acquisition through experimentation, 2.Feature based modeling and part feature extraction, 3.Manufacturing logic formulation and process planning system development and 4.Validation.

Primarily, experimentation on Poly-methyl methacrylate and C360 Brass work materials were carried out for micro end milling process. C360 Brass material is chosen for micro turning and micro drilling processes. Response surface methodology and Taguchi based design of experiments were carried out. Analysis of variance has been performed to examine the influence of process variables. Process parameters optimization

have been carried out using Genetic Algorithm and validated with confirmation experiments. Apart from experimentation, parameters are established from literatures, manufacturer catalogues and user's manuals and then stored in the database.

Feature based modeling for part model generation and Extensible markup language schema has been incorporated for part feature extraction. Part feature verification also carried out for Micromachining centre capability. There by, the proposed approach avoids complex feature extraction process and ensures integration of design and process planning system.

Manufacturing logic was formulated for the execution of various process planning activities. Accordingly, database has been developed for process sequence, tools, fixtures, process parameters and setup selection. Knowledge based system has been developed by incorporating the production rules. Hence, based on part feature information, IPPS performs autonomous decision making in process plan generation.

A new methodology for automatic Computer Numerical Control (CNC) code generation is exemplified for 2.D micromachining. Hence based on feature information, workmaterial and parameters, CNC code generation takes place automatically. It minimizes the program development time and compatibility issues. Proposed IPPS is integrated with Micromachining centre online. Validation has been carried out through the production of axis symmetry and prismatic components. There by, the developed IPPS assist in decision making for process plan and CNC code generation for the production of miniature and micro parts and it ensures true CAD/CAM integration.

Keywords: Micromachining; Intelligent process planning; Feature based modeling;

Knowledge based system