# ABSTRACT

A well-integrated design and manufacturing system should not only provide a rich set of features making it possible to design complex parts with greater flexibility, but also be able to automatically generate numerical control part programs to produce the designed parts. The goal of this research into the integration of Computer-Aided Design and Manufacturing is to support the design, modification, analysis, optimization, and manufacture of mechanical parts with complex shapes automatically and efficiently within a unified framework.

A feature-based approach is used to combine *parametric design* paradigms and *computer-aided process planning* techniques, which also includes freeform curves and surfaces as higher-order features. The approach is to design a part using predefined, but flexible, hybrid design/manufacturing features, and then use the design procedure as the basis of process planning for the production, mainly machining, of the part. Therefore, a part design not only specifies the geometry and functionality of a product, but also provides a plan to automatically generate the NC part programs to machine the specified features, and hence the whole part.

A prototype system for two-and-one-half-dimensional and three-dimensional features has been designed and implemented to demonstrate key components of the research, which includes feature decomposition, tool selection, feed/speed computation, operation reordering, and code generation. Design issues and algorithms for geometric and manufacturing analysis are presented.