

3.0 Literature Review

Mechanical CAD systems began as automated drafting tools for the production of engineering drawings [Krou84]. However, software applications have now found widespread usage in various areas of mechanical engineering.

The design procedure for the design of machine elements has been well documented over the years. Several textbooks and handbooks have been written about the machine elements used in mechanical design [Rata98]. These design procedures are readily available for reference in the design books written by Shigley [Shig83], Spotts [Spot85], and Mott [Mott85], to name a few. Mechanical design equations that relate performance and functionality to design variables are often highly coupled, non-linear parametric equations. The structure of these interacting equations can be simplified by a reformulation based on alternative design variables. To minimize the complexity and degree of coupling, Watton and Rinderle [Watt90a] [Watt90b] have developed methodologies to improve mechanical design decisions with alternate formulations of constraints. Welch and Dixon [Welc91] have worked on design tools to guide the design process using the iterative redesign model of design.

The automation of the machine element design process is becoming an essential part of many modern industrial organizations [Hega91]. There are several computer applications that have been developed for the design of machine elements. Conceptual designers are incorporating a number of software tools into their work [Putt93]. Coded programs using conventional programming languages, i.e., BASIC, C, FORTRAN or Pascal, have been developed [Offn71] [Pras86] [Hega91]. Prasad and Kinzel [Pras86] developed a case selection routine for interactive design programs using a spring design program. Kinzel and Walliser [Kinz86] developed a general procedure for developing interactive machine design software. Smaili, Ahmad, and Henry [Smai93] developed a computer-aided package for design of transmission shafts. Computer programs are being developed through software toolboxes in order to create computer programs for mechanical applications so that mechanical aspects are separated from data processing aspects [Play89]. However, most of these applications are limited in scope and utility. For example, many of these applications limit the programs to variations of the predefined independent variables in specific examples [Offn71] [Pras86] [Kinz86]. These applications limit a numerical study since a designer can input changes only in the predefined independent variables. Exploring different combinations of the fixed known and unknown variables requires that the computer program (design equations) be rewritten. Spreadsheet softwares have also been developed to help the machine designer in the design process [Renc96] [Thom93] [Goat92] [Zhom95]. However, these attempts to automate the design process focuses a majority of the designer's creativity on the computer program rather than the physical problem.