STRUCTURED DEVELOPMENT OF THE COMPUTER AIDED DESIGN SYSTEM IOD

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Abstract

A CAD system emphasizing creative development of new design ideas is discussed. The system assumes no computer knowledge. Beside the use of menus and prompts, the user has only to learn a mini programming language for formulation of arithmetic and boolean expressions. The system utilizes a data management system fitted for engineering design. With the retrieved data the user constructs, through menu guidance, a constrained non-linear model of his design. Interactive optimization of the model facilitates introduction of useful trade-offs.

The structured development of the CAD system is discussed. First an unsophisticated prototype was implemented. The insight gained form this implementation enabled significant improvements that could not have been suggested without this insight. This technique involves however a repeated implementation of sizable parts of the system. The costs of these repeated implementations were reduced by employing principles of having code for a certain activity only one place in the program, and of accessing complex data structures only through special functions.

The APL language proved very useful for the project. An analysis is made of the properties that made APL so useful in spite of its poor program structuring facilities.
1. Introduction

The subject of this paper is an experimental system for studying computer aided design (CAD) emphasizing designer creativity. In the first part of the paper the system will be discussed from the point of view of a user. In the second part of the paper the techniques employed for the structured development of the large system will be analyzed.

One of the objectives of the system was to facilitate the utilization of the insight gained by the designer through the process. An example is the engineer, who through the process of designing a new machine learns that some of the original specifications involve very high costs. He will then analyze these specifications and may decide to change them. Another example is when the insight gained through the design process inspires the designer to employ new principles, whereby advantages that have not been foreseen at the beginning of the design process, are achieved. It was felt that such a system should

1. Support the psychological learning process through which the designer gains an understanding of the properties of his design, e.g. through display of graphs that illustrate these properties.

2. Be handled in a simple and obvious way such that the designer can invest the most of his mental resources in the design process.

3. Provide a data base from which data needed for the design may be retrieved in a convenient way.

4. Provide computational capabilities, e.g. for statistics, that may be used with a minimum of knowledge in mathematics and computers.

5. Provide a methods data base enabling a convenient search of procedures that may be of use to solve problems encountered through the design process.

This paper discusses the IOD (Interactive Optimum Design) system which attempts to meet the above requirements. The data base and the method data base systems to be used are described in (10) and (8) respectively. A program called INTERFACE that interfaces the IOD system with the terminal and with subroutines written in other languages, e.g. FORTRAN was written by M. Bergen (4). It is intended