An Expert System for MetaIforming

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Abstract

Expert system technology as an area of artificial intelligence is coming to the field of metalforming processes. A number of expert systems have been developed or are under development. An intelligent knowledge based system that has user friendliness with tools to implement CAD is attempted to help the engineer in industry and research. An example of forming of axisymmetric bars with simple extrusion is used to illustrate new possibilities. The software package described in this paper is applicable on personal computers and is provided with comprehensive functions. The principle is that the designer will interrogate the knowledge base for the production of a particular component starting with material selection going upto design. The paper consists of two parts. A brief discussion of the basis of expert systems and their concepts is given in the first part. The second part illustrates the prototype expert system developed to aid the designer.

Introduction

Expert systems are problem solving programs which model human expertise and apply logical reasoning to the knowledge base in solving problems. They are regarded as a means of recording and accessing human expertise in a particular field. Expert systems have been developed and applied successfully in the field of medical diagnosis (e.g., MYCIN, INTERNIST, CADUCEUS). In the field of metalforming there is a growing interest for the possibilities that the technology of knowledge based systems could bring into the domain. The metalforming techniques can greatly reduce material waste, ensure good surface finish and tolerances in the manufacture of engineering components. For their full potential to be realised the assistance of experienced engineer is essential. Expert system could be of great value in this application by making the knowledge
of human expert more easily accessible and widely available. In the following section we will briefly summarize the concepts of expert systems. Further a prototype expert system for cold extrusion with its salient features will be described.

Concepts of Expert Systems:

Expert systems are usually applied to narrow specialised fields to make high level expertise available and accessible to many users at any time in a consistent quality unlike the human expert who cannot always provide the same advise in the same situation. The basic elements of an expert system are the knowledge base containing the domain of knowledge and the inference engine which solves the problem by interpreting the domain knowledge. The user interacts with the system through a User Interface(fig.1) and gets access to the Knowledge Base via the Inference Engine. The Data Acquisition Module enables the knowledge engineer to furnish additional knowledge. It is also possible to interact with External Databases or conventional programs through interfaces taking the help of Explanation Module.

Knowledge representation plays an important role in developing an expert system. To get an efficient reasoning process the level of representation of knowledge should conform to the real world knowledge closely. Knowledge can be classified in many different ways depending on what it represents (e.g., knowledge based on experience and heuristics, knowledge based on first principles and general theories, metaknowledge). In general, knowledge representation can roughly be divided into two main categories: declarative and procedural. In declarative mode, knowledge is represented as a static collection of facts which will require a set of general procedures to manipulate them. Procedural mode represents knowledge as procedures. Advantages of declarative representation are convenience of adding new facts to the