ABSTRACT

The aim of the present work is to contribute to the development of knowledge-based system for intelligent design of progressive dies. A knowledge-based system framework has been developed for intelligent design of progressive dies. To construct the system modules, a procedure has been formulated. The present investigation has mainly five facets, namely the development of a knowledge-based system module for checking of design features of sheet metal parts, intelligent CAD system for modeling of strip-layout, construction of system modules for selection of die components, automatic modeling of die components and die assembly, and selection of materials for progressive die components.

A module has been developed for checking of design features of sheet metal parts from manufacturability point of view. The module is capable of checking the part design features such as size of blank, size of holes, hole pitch, corner radius, distance of the internal features from the edge of the part, distance between two internal features, width of recesses or slots or projections, bend corner radius etc. Another module has been developed for assisting the users in selection of suitable type of die for producing sheet metal parts.

A module has been designed for determining the orientation of blank for maximum possible utilization of sheet. For automating the process of strip-layout design of progressive dies, an intelligent system has been developed. The system imparts intelligent advices for the type of sheet metal operations required for manufacturing the parts, sequencing of operations, selection of proper piloting scheme, deciding number of stations, staging of operations on progressive die and selection of strip-width and feed distance. The system finally models the strip-layout automatically in the drawing editor of AutoCAD. Another module has been developed for assisting the users in the selection of suitable type of press machine of required tonnage capacity.
For selection of progressive die components, a knowledge-based system has been developed. The output from the system modules includes the type and proper dimensions of progressive die components namely die block, die gages, stripper, punches, die-set, punch plate, back plate and fasteners. The system has been designed in such a way that the advices imparted by its modules are automatically stored in different data files.

An intelligent system has been designed for automatic modeling of progressive die components and die assembly. The developed modeling system automatically models major progressive die components namely die block, die gages, stripper plate, back plate, punch plate, bottom bolster & top bolster of die-set and die assembly.

To tackle the problem of selection of suitable materials for progressive die components, an intelligent system has been developed. The system renders intelligent advices for selection of materials for progressive die components and selection of close hardness range of selected materials of active components of progressive dies.

The proposed knowledge-based system for intelligent design of progressive dies overall comprises of more than 650 production rules of IF-THEN variety coded in AutoLISP language. However, the system is flexible enough as its knowledge base can be modified and updated depending upon the capabilities of a specific shop floor and advances in new technology. System modules are user interactive and designed to be loaded in to the prompt area of AutoCAD. The proposed system has been tested for a wide variety of industrial sheet metal components. Recommendations imparted by the system for checking the design features of sheet metal parts, strip-layout design, selection of die components and suitable materials for progressive die components and drawings generated by the system were found to be reasonable and very similar to those actually practiced in stamping industries. The system can be implemented on a PC having AutoCAD software and therefore its low implementation cost makes it affordable by small and medium size enterprises.