

## Knowledge-based expert system

As an outcome of intensive research and development at the department of civil engineering, Indian Institute of Technology Madras, a knowledge-based expert system was developed called DEKBASE (development environment for knowledge-based systems in engineering). The following three knowledge-based system using DEKBASE have also been developed.

### **INDUS**

It is a prototype KB system for planning of layout, generation of appropriate truss system, analysis and component design of steel industrial structures. The knowledge bases were developed through interaction with one of the leading private sector companies dealing with design and construction of steel structures in India. *INDUS* consists of several knowledge modules. The control knowledge is reposed in a meta level knowledge base, that controls the problem solving session. The other knowledge bases are the domain knowledge bases that are called upon by this control knowledge base to perform special tasks.

### **ODESSY**

*ODESSY* (office building design system) is capable of planning the layout, generating framing plans and performing the conceptual and preliminary design of reinforced concrete buildings. The knowledge bases were established through a close interaction with the engineers of a leading

government organisation and a practising architect.

The first part involves an examination of the design process to identify the issues to be addressed in providing knowledge-based solutions to the building design problem. The design strategy adopted is based on the, "generate and test strategy". This model of the design process is very similar to the one adopted by designers. The development of *ODESSY* defines an approach for the design of complex artifacts requiring the co-operative participation of multiple specialists.

### **SETHU**

*SETHU* is an integrated knowledge-based system for addressing the various tasks of site selection, conceptual and preliminary design of concrete road bridges. An experienced bridge design engineer was associated with this project to provide the expertise needed for the development.

Integration in *SETHU* is done at three levels. At the first level, two approaches (namely heuristic and case-base) have been integrated to exploit their respective advantages. Within each approach, various stages of design that formalised separately are integrated for incremental development of the solution. Within each design stage, various artificial intelligence techniques such as production rule-based inference technique, decomposition and constraint-

based synthesis techniques, rating and relative importance based critiquing technique, procedural programming techniques and data-based techniques are integrated to accomplish the task being addressed in that particular stage of design.

### **PASSFEM**

It is a program for analysis of structural systems by finite element method both linear and nonlinear.

For the analysis of structural systems using finite element method, *PASSFEM* with a modular form for element library has been developed. *PASSFEM* is organised to form a general purpose program to analyse structures using any of the elements or a combination of the elements in the element library in the linear range.

*PASSFEM* has been enhanced presently with the inclusion of the nonlinear version, *PASSFEM-NL*, which has both kinematic as well as constitutive nonlinearity, using the arc-length in conjunction with Newton-Raphson's method as the solution strategy.

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