RATIONALIZATION OF PRESTRESSED CONCRETE SPINE BEAM DESIGN PHILOSOPHY FOR EXPERT SYSTEMS

by

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Abstract

The most important aim of expert systems is to emulate the expert. The majority of existing expert systems for design try to achieve this by integrating the phases of the design process within one software environment thus achieving an overall automation. These integrated systems tend to support design by numerous repeated analysis due to their inability to suggest good preliminary solutions. The feedback from numerical analyses is needed to modify the preliminary solutions.

It is argued here that human experts have a different approach to design problems. They try to minimize the iterative nature of design by suggesting preliminary solutions which have a higher chance of succeeding at the subsequent detailed design stage. Expert systems should be able to do the same. Ideally, good preliminary solutions should be tailored to the requirements; this means that they should take account of the majority of constraints and structural behaviors quantitatively while selecting the values for key design parameters. It is suggested here that the numerical processing power of the computer should be used to obtain good preliminary solutions by developing design algorithms, which can take account of governing factors at an early stage of the design process. These in turn can be used to encapsulate knowledge in the expert systems instead of the 'heuristics' which are used to incorporate past experience in existing expert systems.

In order to develop these design algorithms, it is necessary to unravel the rationale behind each decision made during the preliminary design stage. In this thesis, the work carried out to rationalize the philosophy of the design process of prestressed concrete spine beams is explained in detail. The main advantage of this approach is that the expert system is compact and fast in execution. It is also capable of guiding the designer in a consultation session either by suggesting appropriate values or allowable ranges for key design parameters, as is done by a human expert.
Keywords: Prestressed Concrete, Spine Beams, Bridges (structures), Expert Systems, Prolog, Deep Knowledge