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AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

STRUCTURAL ENGINEERING DEPARTMENT

EXPERT SYSTEM ON REPAIR AND STRENGTHENING OF CONCRETE ELEMENTS AND STRUCTURES

BY

B 5755

MAMDOUH TAWFIK MAHMOUD DONIA

A THESIS

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of philosophy of doctoral in structural engineering.

The work includes in this thesis was carried out by the author in the Department of Structural Engineering, Ain shams University, from January 1993 to July 1995.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

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ABSTRACT

The purpose of this thesis is to develop a knowledge-based expert system for the practical applications of repair and strengthening of concrete structural elements. The developed system, written in micro-computer shell (VP-EXPERT), is capable of providing the microcomputer user with the various approaches of diagnoses, evaluation and strengthening of various defected concrete structural elements such as slabs, beams, columns and masonry & in-situ concrete walls. The system contains testing, diagnostic, evaluation of experimental strengthening approaches and practical construction stages. The developed knowledge base is acquired, formalized and constructed using Iterative Dichotomiser 3 (ID3) mathematical algorithm, production representation procedure, and the process of backward chaining as inference engine approach.

The thesis includes a general introduction for buildings in EGYPT and the objectives of repairing and strengthening techniques as well as general causes, types and shapes of building defects. Some basic definitions concerning, mainly, with repairing, strengthening and programming techniques are introduced. Also the role, distinction, contrasting features, building tools and interaction modes with other computer systems of the knowledge-based expert system are introduced.

Literature survey is presented for some published researches

concerning with the expert system applications in repairing and strengthening field together with an explanation of most different assumptions which have been considered in these researches. Description of the system tools (including both VP-EXPERT shell and EUREKA mathematical systems), system stages, the features of VP-EXPERT shell and the used knowledge acquisition and formalization concepts are presented.

Introduction and characterization of all studies in each system stage are presented. Identification, source of knowledge, application area, purpose, system parametric attributes with their values, attributes dependency, decision tree and the expected output of each study are illustrated.

Evaluation and verification of system are presented to explain the significance of using the ID3 mathematical algorithm in the reduction of redundant information as well as dealing with enormous amount of data. There are many examples and case studies are verified on the system to explain its powerful in the practical applications of strengthening of concrete structural elements.

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