Finite Element Analysis For Reinforced Concrete Joints

By

Alaa El Deen Amr Hussein Shaaban

B.S.C.Civil Engineering,Ain Shams University,2009

A Thesis submitted in Partial Fulfillment

Of

The requirements for the Master Degree

In

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Department of Structural Engineering

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A Thesis for Master Degree In Structural Engineering science has been approved by;

Name; Signature

1-Prof. Dr. Hadad Saeed Hadad

Prof. of reinforced concrete at the national research centre

2-Prof. Dr Mohammed Hussein Attaby

Prof. of structures,Faculty of Engineering - Ain Shams University

3-Prof. Dr. Amin Saleh Aly

Prof. of structures,Faculty of Engineering - Ain Shams University

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Under Supervision of ;

1-Prof.Dr. Amin Saleh Aly

Prof. of structures,Faculty of Engineering-Ain Shams University

2-Prof .Dr. El Sayed Ibrahim El sayed Mostafa

Prof. of reinforced concrete,Faculty of Engineering-Ain Shams University

Information About the researcher

Name	; Alaa El Deen Amr Hussein Hussein
Date of Birth	; **21 /6 / 1986**
Place of Birth	; Nasr city – Cairo - Egypt
Qualification	; B.Sc inCivil Engineering
	Faculty of Engineering
	Ain Shams University ,2009

Statement

This dissertation is submitted to Ain Shams university for the degree of Master of science in Civil Engineering (structural).

The work included in this thesis was carried out by the Author in the department of Civil Engineering (structural division, Ain Shams University, from 2010 to 2014.

Non part of this thesis has been submitted for a degree or a qualification at any University or Institute.

Date ; 1 / 6 / 2014

Name ; Alaa El Deen Amr Hussein

Signature ;

ABSTRACT

Alaa El Deen Amr Hussein, On A Finite element analysis for reinforced concrete joint, Structural department Faculty of Engineering Ain Shams university.

The nonlinear behavior that associates reinforced concrete structures through loading stages due to changes in material properties and geometrical deformations are one of the most controlling criteria in the behavior of reinforced concrete structures. Efforts have been done to model this behavior, and these efforts were the basis of the present research beside a trial to develop new solving technique and analytical computer program to save time and be more precise .A reinforced concrete joint was chosen as a case study and many steps were taken to judge the developed program. The previous efforts were studied, A theoretical assumptions were assumed for the new method of analysis considering the structure is entering every new load increment with new deformed calculated geometry, and assuming a material stiffness matrix that changes its material components with load increments. An experimental reference for the studied case was done to give a datum and a real behavior to be used to calibrate the developed computer program. A computer program was developed using JAVA language as well as assembly of its parts and adjusting to comply with the new analytical assumptions beside using the program as an easy input - output tool in the research field, the program is explained and attached. The research examined the software and calibrates its suitability by comparing it with that reached from experimental study, the case study gave a good correlation with the experimental results and the previous studies for the failure loads but still more efforts are needed to reach the ideal representation for the crack deflection and behavior

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CHAPTER 1

Introduction

.1) General

The actual behavior of reinforced concrete structures is governed by two different forms of nonlinearity namely material nonlinearity and geometrical nonlinearity.. Material nonlinearity is due to cracking and nonlinear stress-strain relationship of the constitutive materials, while geometrical Non linearity is caused by large deformations - resulting in significant changes in the geometry of the structure and thus the assumption of linear strain-displacement relationship breaks down.

The treatment of reinforced concrete beams and frames, as recommended by various codes of practice is still based on a linear elastic analysis assumption while they are designed on the basis of ultimate strength conditions Considering the inelastic material behavior. The actual behavior of such structures may significantly differ from that obtained using simple linear elastic methods and gross member stiff nesses. In fact, the member stiffnesses should reflect the degree of cracking and inelastic action.

The ACI 318 Building Code(1) accounts for the effect of cracking and inelastic behavior of reinforced concrete elements in some cases through the use of modified stiffness factors to avoid significant moment redistribution and imposing upper limits on the percentages of flexural steel in order to insure a ductile structural response. This empirical treatment, however, is not generally applicable for all cases.