



**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**

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**In**

**Structural Engineering**

**Department of Structural Engineering**

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## Statement

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

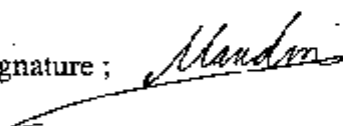
The work included in this thesis was carried out by the Author in the department of Civil Engineering (structural division, Ain Shams University, from 2010 to 2014.

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

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## ABSTRACT

*Alaa El Deen Amr Hussein, On A Finite element analysis for reinforced concrete joint,  
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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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<b>ABSTRACT</b>	<b>I</b>
<b>ACKNOWLEDGMENT</b>	<b>II</b>
<b>TABLE OF CONTENTS</b>	<b>III</b>
<b>LIST OF TABLES</b>	<b>VI</b>
<b>LIST OF FIGURES</b>	<b>VII</b>

## **CHAPTER 1 INTRODUCTION**

1.1) General .....	1
1-2) Historical Backgrounds .....	2
1-3) Scope of the Present Study .....	12
1-4) Phases Organization .....	12

## **CHAPTER 2 MODELLING OF MATERIAL BEHAVIOR**

2.1) General .....	13
2.2) Concrete in Compression .....	14
2.3) concrete in Tension .....	21
2.4) Steel Reinforcement .....	25

## **CHAPTER 3 EXPERIMENTAL WORK**

3.1 objective of work .....	27
3.2scope of work .....	27
3.3 Details of tested specimens .....	28



3.4 Materials .....	29
3.4.1 concrete .....	29
3.4.1.1 Concrete Mix.....	29
3.4.1.2 control tests .....	29
3.5 casting and curing .....	33
3.5.1- Method of concrete pouring.....	33
3.5.2-Method of compaction .....	33
3.5.3- concrete cover .....	33
3.5.4- concrete curing .....	33
3.6-Equipments and Instrumentation. ....	33
3.7 Laboratory Pre Tests Results .....	34
and Behavior Prediction	

## CHAPTER 4 COMPUTER PROGRAM

4.1 Introduction .....	35
4.2 Method of analysis .....	35
4.3 Java Programming .....	38
4.3.1 JDK .....	38
4.2.2 Eclipse ide .....	38
4.4 Jlinpro program .....	39
4.4.1 program organization tree .....	40
4.4.2 PHILOSOPHY OF PROGRAMMING.....	41
4.5 Adjustments on Jlinpro .....	41
4.5.1 Non linear calculation bases .....	41

4.5.2 Steps of Nonlinear Analysis .....	41
4.6 Achievement of results .....	42
4.7 Solution Explanation (jlinpro program) .....	42
4-7-1 input Structural Information .....	42
4.7.2 Calculation of element stiff. Matrix .....	43
4.7.3 Assembly of global stiff matrix .....	46
4.8 The Program (crack) .....	47
4.8.1 Solution Alignment .....	48
4.8.2 Equilibrium Equations .....	48
4.8.3 Determination of initial strain value .....	49
And cracking moment	
4.8.4 Crack calculation and propagation .....	49
4.8.5 Failure criteria .....	50
4.8.6 Java code Explaining .....	50
4.8.6.1-Assigning input data.....	50
4.8.6.2-Preparing model to ask for variables.....	51
4.8.6.3 Assigning stress strain curves, formulation.....	52
for Convergence equations and establishing loops for	
values of e to solve for convergence.	
4.8.6.4 Printing solution ,solving for ctension and achieving/printing Merack .....	53
4.8.6.5-Recalculating with new increment, Elimination .....	54
of cracked slices, Identifying modified variables.	
4.8.6.6-Establishing for DCrack, calculation/identifying/.....	55
printing for every load step	
4.8.6.7-Stopping for failure and printing failure loads.....	55

## CHAPTER 5 APPLICATIONS , RESULTS AND COMPARISONS

5.1 INTRODUCTION.....	56
5.2 Testing the present method of analysis as well as the computer.....	56
Program	
5.2.1 Testing of the present computer program .....	56
Example 1 Reinforced concrete joint.....	56
Example 2 ; 1% IMME beam .....	59

## CHAPTER 6 CONCLUSIONS

Conclusions .....	61
Recommendations for further studies.....	64
REFERENCES .....	80
APPENDIX A .....	67
FIGURES .....	85

## LIST OF TABLES

	Page
Table 3.4 Concrete Design Mix.	28
Table 3.4-a Concrete Cubes before the test.	29
Table 3.4-b Concrete cylinders before the test.	29
Table 3.4-c Concrete properties check List	30
Table 3.7 CORRELATION BETWEEN COMPUTER RESULTS AND LABORATORY WORK RESULTS AND THE BEHAVIOR CRITERIA	32
Table 5.1-c Correlation between experimental ultimate load and computer failure load	53

## LIST OF FIGURES

**Fig 1.1 Four Branch Idealized Moment Curvature Diagram**

**Suggested by Iazaro and Richards (2)**

**Fig 1.2 Typical moment-curvature Relationship of concrete sections**

**And non unique determination of the element response**

**Fig 2.1 Typical stress strain curves for concrete in axial compression**

**Fig 2.2 Axial load strain curves for concrete prisms**

**Fig 2.3 Dimensions and details of column unit tested by park**

**Fig 2.4 Idealized stress strain curves for concrete in uniaxial compression**

**Fig 2.5 Linear stress-strain idealization for concrete in tension**

**Fig 2.6 Some of the frequently Utilized models for concrete in Tension**

**Fig 2.7 Stress strain curves for concrete based in Experimental data**

**Fig 2.8 Idealizations for the stress-strain curve for steel in Tension and Compression**

**Fig 3.1 Testing frame and alignment**

**Fig 3.1,3.2 Dimensions and details**

**Fig 3.4 compression testing machine**

**Fig 3.5 Strain gages distribution**

**Fig 3.6 Dene points distribution**

**Fig 4 Newton Raphson solution**

**Fig 4.1 Program Flow chart**

**Fig 4.2 geometrical Definition and cross section layered system**

**Fig 5.1-a Reinforced concrete joint**

**Fig 5.1-b Load displacement curve for reinforced concrete joint**

**Fig 5.2-b Steel yield strength**

**Fig 5.3 Results for the beam study**

# **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.