

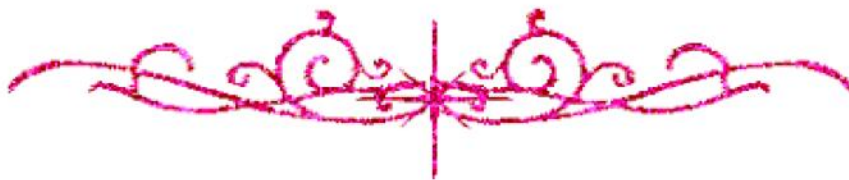
# بسم الله الرحمن الرحيم



**HOSSAM MAGHRABY**



# شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



HOSSAM MAGHRABY

# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

### قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
على هذه الأقراص المدمجة قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

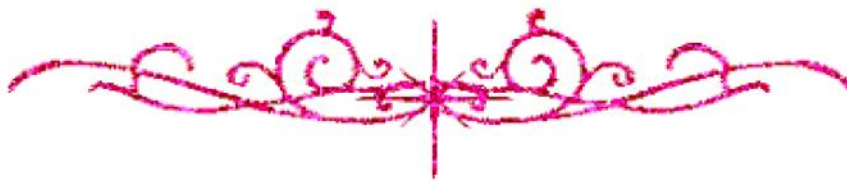


A decorative flourish in red ink, consisting of a central vertical line with symmetrical, flowing, scroll-like patterns on either side.

**HOSSAM MAGHRABY**



# بعض الوثائق الأصلية تالفة



**HOSSAM MAGHRABY**



بالرسالة صفحات

لم ترد بالأصل



HOSSAM MAGHRABY

**DESIGN OF COMPOSITE  
BEAM-COLUMNS UNDER  
BIAXIAL BENDING**

B16490

**THESIS**

**Submitted in Partial Fulfillment of the  
Requirements for the Degree of**

**DOCTOR OF PHILOSOPHY  
IN  
STRUCTURAL ENGINEERING**

By

**Manal K. Zaki B.Sc., M.Sc.**  
B.Sc. 1987, M.Sc. 1993  
Cairo University

**FACULTY OF ENGINEERING, CAIRO UNIVERSITY**

**GIZA - EGYPT**

**May 2001**



# **DESIGN OF COMPOSITE BEAM-COLUMNS UNDER BIAXIAL BENDING**

## **THESIS**

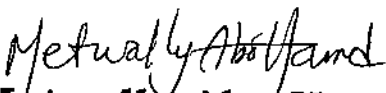
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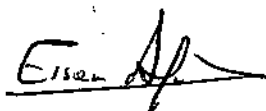
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UNDER THE SUPERVISION OF

  
**Dr. Metwally Abo-Hamd**  
Professor of Steel Structures  
Faculty of Engineering  
Cairo University

  
**Dr. Essam F. Ayoub**  
Assistant Professor  
Faculty of Engineering  
Cairo University

**FACULTY OF ENGINEERING, CAIRO UNIVERSITY**

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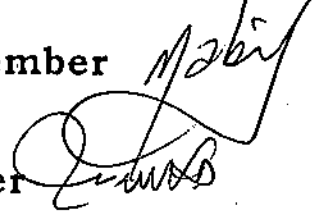
**By**

Manal K. Zaki B.Sc., M.Sc.

**Approved by the Examining Committee**

Prof. Dr. Metwally Abo  Hamd, Thesis Main Advisor

Prof. Dr. Nabil El- Atrouzy, Member 

Prof. Dr. Hasan Ereiba, Member 

**FACULTY OF ENGINEERING, CAIRO UNIVERSITY**

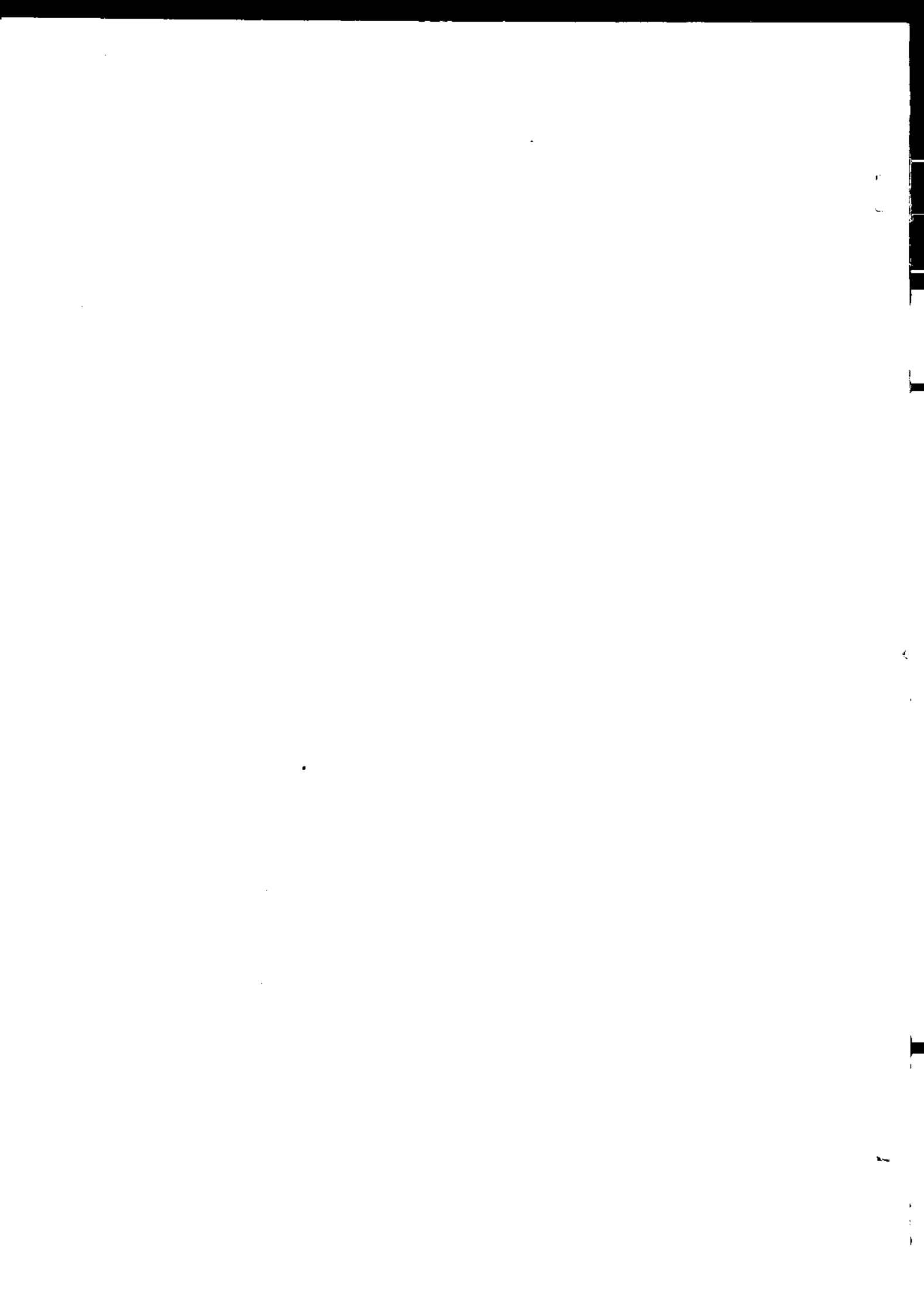
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## **ACKNOWLEDGEMENT**

This thesis was prepared under the supervision of Professor Dr. Metwally Abo-Hamd and Dr. Essam Ayoub to whom the author wishes to express her deep gratitude for their precious advice, invaluable scientific guidance and continuous encouragement throughout the course of this thesis.



## **ABSTRACT**

The thesis is divided into two parts as given below:

- **Part I:** Analysis of the composite column.

The finite element method is introduced to solve the problem of composite beam-columns under biaxial bending. The incremental loading procedure is applied to take into account the material and geometric nonlinearities.

Necessary modifications are introduced to the classic derivation of the stiffness matrices to be applicable for beam elements with unsymmetric cross-sections.

A parametric study has been performed to consider the effect of concrete strength, steel grade and steel profile on the composite-columns.

Contour lines are provided to determine the capacity of the column for different models having different slenderness ratios.

Simple formulas are deduced to describe the relation between the moments and each of the concrete strength or steel grade under a specified axial load.

A complete computer program has been developed to solve the problem of composite-columns under biaxial bending having any slenderness ratio.

- **Part II:** Optimization

The optimal criteria is adopted to achieve the composite column having the least cost.

