AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL DEPARTMENT

NONLINEAR RESPONSE OF COLUMNS STRENGTHENED BY NON-SYMMETRIC CONCRETE JACKETS UNDER ECCENTRIC VERTICAL LOADING

Thesis

Submitted for the Partial Fulfillment of

The Requirements for the Degree of Doctor

Of Philosophy in Structural Engineering

By

Mohamed Ahmed Abdallah AL-Azzouny

M.sc. Structural Engineering (2008)

B.Sc. Structural Engineering (2002)

Ain Shams University Faculty Of Engineering

Under the Supervision

Prof. Dr. Ahmed. A. Korashy
Professor of Structural Eng.
Ain Shams University

Dr. Hany. M. A. El Shafie
Assoc. Prof. of Structural Eng.
Ain Shams University

Dr. Hisham. A. El Arabaty
Assoc. Prof. of Structural Eng.
Ain Shams University

Cairo, Egypt

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APPROVAL SHEET

Thesis : Doctor of Philosophy in Structural Engineering

Student Name : Mohamed Ahmed Abdallah AL-Azzouny

Thesis Title : Nonlinear Response of Columns Strengthened By Non-Symmetric Concrete Jackets under Eccentric Vertical Loading

Examiners Committee :	**Signature**
Prof. Dr. Nabil Ahmed Fouad Professor of Structural Engineering, Hanover University, Germany	……
Prof. Dr. Amr Aly Abdel Rahman Professor of Structural Engineering, Faculty of Engineering, Ain Shams University	……
Prof. Dr. Ahmed Abdelmonem Korashy Professor of Structural Engineering, Faculty of Engineering, Ain Shams University	……
Dr. Hisham Ahmed El-Arabaty Assoc. Professor of Structural Engineering, Faculty of Engineering, Ain Shams University (Supervisor)	……

Date: 01/ 06 / 2017

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Thesis **:** Doctor of Philosophy in Structural Engineering

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Supervisors Committee : **Signature**

Prof. Dr. Ahmed Abdelmonem Korashy **……**
Professor of Structural Engineering,
Faculty of Engineering, Ain Shams University

Dr. Hany Mohamed Abdelfattah El-Shafie **……**
Assoc. Professor of Structural Engineering,
Faculty of Engineering, Ain Shams University

Dr. Hisham Ahmed El-Arabaty **……**
Assoc. Professor of Structural Engineering,
Faculty of Engineering, Ain Shams University

Registration Date: 11 /3 / 2009
Examination Date: 01 / 06 / 2017

INFORMATION ABOUT THE RESEARCHER

Name : Mohamed Ahmed Abdallah AL Azzouny

Date of Birth : May 4, 1980.

Place of Birth : Giza, Egypt

Qualifications : M. Sc. Degree in Civil Engineering (Structural),
Ain Shams University (2008).
B. Sc. Degree in Civil Engineering (Structural),
Ain Shams University (2002).

Present Job : Senior Structure Design Engineer at ACE Consultant
(Moharam Bakhoum)

Personal Mail : m_a_azz@yahoo.com

Contact Phones : 01005498744 , 01116655243

STATEMENT

This thesis is submitted to Ain Shams University for the degree of Doctor of Philosophy in Civil Engineering (Structural).

No part of this thesis has been previously submitted for obtaining a degree or a qualification before.

Name: Mohamed Ahmed Abdallah AL Azzouny

Date : 01 / 06 /2017

Signature:

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ABSTRACT

AIN SHAMS UNIVERSITY

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Abstract of Thesis Submitted for Partial Fulfillment for the Degree of Doctor of Philosophy in Structural Engineering by:

Eng. Mohamed Ahmed Abdallah AL Azzouny

Title: Nonlinear Response of Columns Strengthened By Non-Symmetric Concrete Jackets under Eccentric Vertical Loading

Supervisors:

1. **Prof. Dr. Ahmed Abdelmonem Korashy.**
2. **Assoc. Prof. Dr. Hany Mohamed Abdelfatah El Shafie.**
3. **Assoc. Prof. Dr. Hisham Ahmed El Arabaty.**

The main objective of this research study is an in-depth investigation of the nonlinear structural behavior of concrete column jackets, with an emphasis on the case of non-symmetric jackets used to strengthen edge and corner under strength columns. A highly sophisticated analytical algorithm is developed, incorporating the nonlinear behavior of the concrete material, together with accurate modeling of the shear transfer mechanism at the contact surface. The relation between normal pressure and the developed shear stresses at the contact surface is studied in detail, and included in the developed analytical model. Finite element models are developed for actual lab specimens, and the analysis results are used to verify the developed model by comparison to available experimental results. A parametric study is performed on a number of actual building rectangular columns strengthened using non-symmetric concrete jackets. The developed analytical model is used to obtain results including the load fraction transferred from the existing column to the jacket for cases of corner, edge and interior columns. The results obtained are utilized to develop an in-depth understanding of the behavior of non-symmetrical column jackets, and provide insight into the behavior of these 3-sided, and 2-sided jackets, and their efficiency in strengthening existing columns. Useful conclusions, and recommendations are provided to assist designers in the field of this research.

Key words: Strengthening, Reinforced Concrete Columns, Non-Symmetric Concrete Jackets, Non-linear Analysis, Finite Element Method.

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