شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

جامعة عين شمس
شبكة المعلومات الجامعية
@ ASUNET

MONA MAGHRABY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

MONA MAGHRABY

Cairo University

DERIVATION OF NATIONAL EXPRESSIONS FOR DAMPING MODIFICATION FACTOR FOR THE DESIGN OF BASE-ISOLATED BUILDINGS

By

Mohamed Hesham Mohamed Mohamed Mansour

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
in
Structural Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2020

DERIVATION OF NATIONAL EXPRESSIONS FOR DAMPING MODIFICATION FACTOR FOR THE DESIGN OF BASE-ISOLATED BUILDINGS

By

Mohamed Hesham Mohamed Mohamed Mansour

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
in
Structural Engineering

Under the Supervision of

Prof. Dr. Adel Yehia Akl

………………………………

Professor of Structural Analysis and Mechanics
Structural Engineering Department
Faculty of Engineering, Cairo University

Assoc. Prof. Dr. Manar Maher Hussein

………………………………

Associate Professor
Structural Engineering Department
Faculty of Engineering, Cairo University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2020

DERIVATION OF NATIONAL EXPRESSIONS FOR DAMPING MODIFICATION FACTOR FOR THE DESIGN OF BASE-ISOLATED BUILDINGS

By

Mohamed Hesham Mohamed Mohamed Mansour

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
in
Structural Engineering

Approved by the
Examining Committee

____

Prof. Dr. Adel Yehia Akl, **Thesis Main Advisor**

____

Assoc. Prof. Dr. Manar Maher Hussein, **Advisor**

____

Prof. Dr. Sherif Ahmed Mourad, **Internal Examiner**

____

Prof. Dr. Mohamed Nour El-Din Fayed, **External Examiner**

- Professor of Structures, Structural Engineering Department, Faculty of Engineering, Ain Shams University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2020

Engineer's Name: Mohamed Hesham Mohamed Mohamed Mansour
Date of Birth: 19/11/1984
Nationality: Egyptian
E-mail: hmansour20@gmail.com
Phone: 01069434902
Registration Date: 01/03/2013
Awarding Date: / /2020
Degree: Doctor of Philosophy
Department: Structural Engineering

Supervisors:

Prof. Dr. Adel Yehia Akl
Assoc. Prof. Dr. Manar Maher Hussein

Examiners:

Prof. Dr. Adel Yehia Akl (Thesis main advisor)
Assoc. Prof. Dr. Manar Maher Hussein (Advisor)
Prof. Dr. Sherif Ahmed Mourad (Internal examiner)
Prof. Dr. Mohamed Nour El-Din Fayed (External examiner)
(Professor at Structural Engineering Department, Faculty of Engineering, Ain Shams University)

Title of Thesis:

Derivation of National Expressions for Damping Modification Factor for the Design of Base-Isolated Buildings

Key Words:
Damping Modification Factor; Base-Isolation; Egyptian Seismic Code; Natural and Artificial Ground Motions; Time History Analysis

Summary:

Damping modification factor is used in international seismic codes for the design of structures with damping levels higher than 5% such as seismically isolated buildings. This study included deriving expressions for that factor using the data of local earthquakes in Egypt. The ground motions used in this study included 26 natural accelerograms and 150 artificial accelerograms. By comparing the derived expressions in this study with the values in two international codes and in previous studies, it was concluded that the natural earthquakes expressions are more recommended for addition to the Egyptian seismic provisions. The natural earthquakes expressions were used to design hypothetical base-isolated buildings lying in seismic zone (5) in Egypt. A seismic performance assessment was done for the designed base-isolated buildings using time history analyses and their responses were compared to their fixed-base counterparts showing an efficient performance for the studied base-isolated buildings.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Mohamed Hesham Mohamed Mohamed Mansour Date: / /

Signature:

Dedication

TO

MY PARENTS,

AND ALL MY FAMILY

Acknowledgements

I would like to express my deep appreciation and sincere gratitude to my supervisor, **Prof. Dr. Adel Yehia Akl** for his guidance, suggestions, valuable advice, support and continuous encouragement throughout my studies.

I also would like to thank **Dr. Manar Mohamed Maher** for her supervision, suggestions, and guidance throughout this thesis.

Thanks are extended to my Professors and my colleagues at the *Housing and Building National Research Center* for their continuous encouragement, support and willingness to help at any time.

Great thanks are to the *Egyptian National Seismic Network* at the *National Research Institute of Astronomy and Geophysics* for providing the acceleration data used in this study.

The Seismosoft Ltd., CADRE Analytic and the GraphPad Software Inc. are greatly acknowledged for providing access to the softwares used in this study.

Finally, I would like to thank my family for their patience and understanding. I must express my deep and great thanks to my parents for their continuous support and encouragement that have always inspired me to work hard and pass the challenges facing me.

Table of Contents

List of Tables