EARTHQUAKE ENGINEERING

Theory and Implementation with the 2015 International Building Code

Nazzal Armouti

THIRD EDITION

ICC
INTERNATIONAL CODE COUNCIL

Mc Graw Hill Education

Earthquake Engineering

Theory and Implementation with the 2015 International Building Code

Nazzal S. Armouti, Ph.D., P.E.
Professor of Civil Engineering
University of Jordan
International Director
International Code Council, ICC

Third Edition

Mc Graw Hill Education

New York Chicago San Francisco Athens
London Madrid Mexico City Milan
New Delhi Singapore Sydney Toronto

Cataloging-in-Publication Data is on file with the Library of Congress.

Earthquake Engineering: Theory and Implementation with the 2015 International Building Code, Third Edition

1 2 3 4 5 6 7 8 9 0 QVS/QVS 19 18 17 16 15

ISBN 978-1-25-958712-2
MHID 1-25-958712-6

The pages within this book were printed on acid-free paper.

Sponsoring Editor
Lauren Poplawski

Editorial Supervisor
Donna M. Martone

Project Manager
Namita Gahtori, Cenveo® Publisher Services

Production Supervisor
Lynn M. Messina

Copy Editor
Cenveo Publisher Services

Proofreader
Cenveo Publisher Services

Composition
Cenveo Publisher Services

Art Director, Cover
Jeff Weeks

Earthquake Engineering

Foreword

This is the third edition of a one-of-a-kind textbook. This book explains the fundamental concepts of structural dynamics and earthquake engineering with an exceptional clarity and an unprecedented quantity of numerical examples that help the reader fully understand the concepts being discussed.

Professor Armouti has done a phenomenal job of explaining the difficult concepts of linear and nonlinear dynamics and structural response to earthquake excitations. The presentation style, simplicity of language, and the vast number of examples help make the concepts presented easily understandable even to those who face them for the first time.

This is an ideal textbook for teaching a first undergraduate or graduate course in earthquake engineering. It not only explains the structural dynamics theories necessary for understanding linear and nonlinear response to earthquake excitations, but also covers the basic design of earthquake-resistant steel and reinforced concrete buildings, bridges, and isolated systems, in accordance with the latest codes of the United States. The provisions of ASCE 7 standard as well as those in the International Building Code (IBC), ACI-318, and AISC seismic provisions are clearly explained and illustrated through numerical examples.

Students of the subject will find this book easy to follow and will appreciate the wealth of numerical examples presented for every small and large issue discussed. The instructors will find this book useful because of the simplicity of the presentation, the extensive number of solved examples, and the problems contained at the end of the first five chapters. To aid instructors in using the book effectively for teaching the subject, an Instructor's Manual containing solutions to end of chapter problems and a set of Powerpoint presentation slides are made available to qualified instructors. Last, but not the least, engineering practitioners will find this book to be an invaluable source of information regarding response of various systems and components to earthquake excitations.

When I was first presented with the manuscript of the first edition of this book by the International Code Council, which was seeking my opinion regarding potential publication in the United States, the first thought that crossed my mind was: an earthquake engineering book from Jordan for the U.S. market? This initial reaction, however, rapidly faded when I went over the contents and the presentation of the book.

I did strongly recommend publication of the first and second editions of this textbook for the U.S. market and I am very pleased to have done the same for this third edition of the book.

Farzad Naeim, Ph.D., S.E., Esq.
President,
Farzad Naeim, Inc.
Irvine, California
Past President,
Earthquake Engineering Research Institute

Acknowledgment

I gratefully acknowledge the help, support, and encouragement received from my family, friends, and colleagues throughout Jordan and abroad which have converted my exhaustion into motivation.

THANK YOU ALL !!!

Earthquake Engineering

Contents