بسم الله الرحمن الرحيم

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NON-LINEAR ANALYSIS OF STEEL BUILDINGS WITH OPTIMIZATION OF DAMPER PLACEMENT

By

Ismail Ibrahim Ismail Amara

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

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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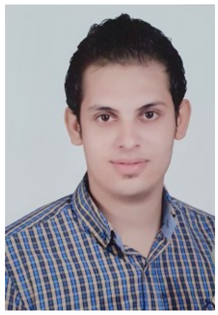

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NON-LINEAR ANALYSIS OF STEEL BUILDINGS WITH OPTIMIZATION OF DAMPER PLACEMENT

Key Words:
Structural dynamics; Inelastic behavior; Tuned mass damper; Nonlinear energy sink; Genetic algorithms

Summary:
This thesis investigates the mitigation of excessive vibrations in multistory steel buildings subjected to lateral loads using linear and nonlinear TMDs. Three types of stiffness mechanisms of TMDs were studied: linear, essential nonlinear (without linear part), and nonlinear (with linear part). Also, an algorithm of the nonlinear direct integration dynamic analysis was developed by MATLAB software. In order to evaluate the effectiveness of dampers in suppressing the undesired vibrations, a set of eight earthquake events possessing a diverse frequency content were used. The minimum dynamic response of the structures for each seismic event was obtained by opting for the proper parameters of the damper. Thus, an optimization process via genetic algorithms (GAs) and particle swarm optimization (PSO) methods was adopted in this study to obtain the optimal parameters and location for each type of dampers.

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: Ismail Ibrahim Ismail Amara Date: / /2022

Signature:

Dedication

To My Parents, Brothers, and Friends.

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