COMPARISON BETWEEN BOUNDARY ELEMENT AND FINITE ELEMENT APPROACHES IN STRUCTURAL ANALYSIS OF DIFFERENT TYPES OF STRUCTURAL SLABS

By

Catherine Bahgat Mesak Estawros

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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Title of Thesis: COMPARISON BETWEEN BOUNDARY ELEMENT AND FINITE ELEMENT APPROACHES IN STRUCTURAL ANALYSIS OF DIFFERENT TYPES OF STRUCTURAL SLABS

Key Words: Boundary Element Method, Finite Element Method, Egyptian Code of Practice**,** Floor slabs, structural elements

Summary:

The Thesis presents comparisons between the Finite Element Method (FEM) and the Boundary Element Method (BEM) for different types of slabs and foundation slabs. Several applications and examples were studied for the structural analysis and numerical modeling of different types of slabs including Solid slabs (Slab and beam type), Flat slab, Hollow block slabs, Paneled beam slabs, Skew plates and Hollow core slabs. The studied foundation slabs include rafts and piled raft foundations. Main software used in the Thesis are SAP2000 and PLPAK program. The SAP2000 program is based on the FEM and the PLPAK program is based on the BEM. Both methods are compared with the Manual calculations for different types of slabs which are based on the provisions of the ECP 203-2007. The results throughout the Thesis present detailed comparisons between the two methods: for example the bending moments and deflections are compared in the form of contours, strips and tables.

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ABSTRACT

The Thesis presents comparisons between the Finite Element Method (FEM) and the Boundary Element Method (BEM) for different types of slabs and foundation slabs. Several applications and examples are studied for the structural analysis and modeling of different types of slabs including Solid slabs, Hollow core slabs, Flat slab, Hollow block slabs, Paneled beam slabs, and Skew plates. The studied foundation slabs include rafts and piled raft foundations. The SAP2000 program is based on the FEM and the PLPAK program is based on the BEM. In this Thesis the FEM and BEM are compared with respect to the manual calculations which are based on the provisions of the ECP203.Other programs like ETABS and SAFE programs were also used beside SAP and PLPAK programs to compare the effect of changing mesh size, column representation, using thin and thick shell theories and varying Poisson's ratio on the bending moment and deflection. The aim of this work is to measure and compare the accuracy, time for solving and time for implementing data between FEM and BEM using SAP and PLPAK programs. The results present detailed comparisons between the two methods: for example the bending moments and deflections are compared in the form of contours, strips and tables.

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