Ain Shams University
Faculty of Engineering

AN EFFECTIVE STRESS CONSTITUTIVE MODEL FOR SOFT CLAY IN 3D STATE

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A Thesis
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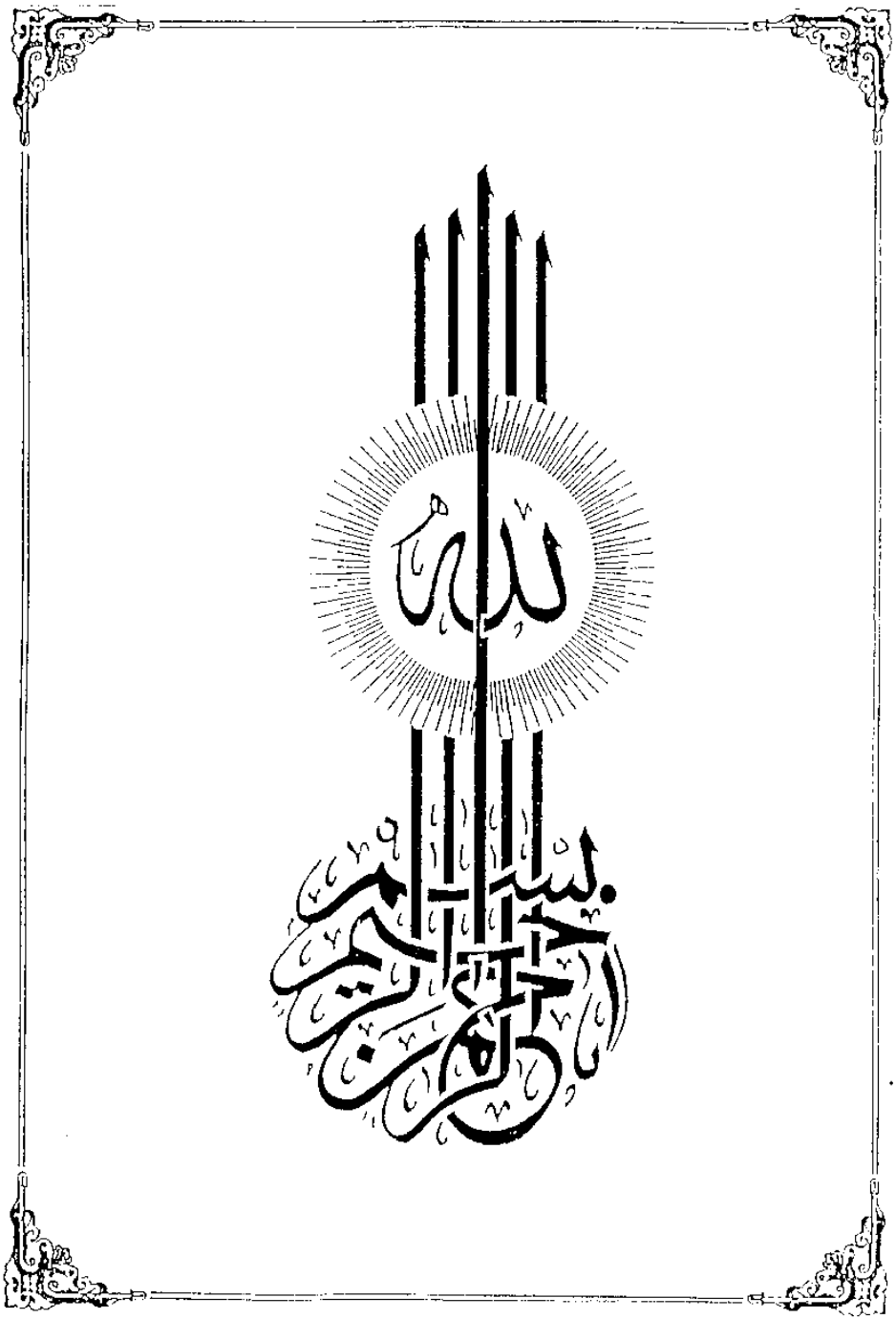

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Abstract of M.Sc. Thesis

Title : ***An Effective Stress Constitutive Model for Soft Clay in 3D State***

Submitted by : ***Mohammad Al-Amin Izazi***

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Abstract

In this research, Cam-Clay model was used to study the consolidation process in clayey soils and sand drains problems, where the accuracy has been checked. The work done in this thesis could be divided in two main parts:

a - First part : Represents the numerical analysis. Where some improvements and new features have been added to a predeveloped finite element code (AINSHAMS). This program implemented the finite element technique in solving the differential equations of Cam-Clay model, to make it able to deal and solve more complicated problems with no limit to the number of used elements. New types of elements were added, all the new elements are higher-order elements. Also new features were added to solve the seepage and consolidation problem in one-dimension, two-dimension and a special case of three-dimension case (axisymmetric).

b - Second part : Covers the history cases, as the validity and the accuracy of the calculation procedures in the new program (AINSHAMS2) have been checked. The new program is used also to simulate three practical problems, an oedometer test, radial consolidation test using a sand column installed in the middle of the soil sample and insitu loading test on sand drains system which was performed in El-Salam canal in Delta region in Egypt. The following factors have been studied:

1. The effect of elastic-plastic behaviour on the settlement-time curve of one-dimensional consolidation test and compare the results with the laboratory measurements,
2. The effect of sand drains on speeding up the consolidation settlements,
3. The effect of smear zone on the productivity of the sand drains,

4. Comparing the results of the numerical analysis with the theoretical results and field measurements in sand drain problem,
5. Evaluating the role of the radial and vertical drainage in the sand drains problem,
6. The efficiency of converting the sand drains problem from the three-dimensional case to an equivalent plane strain problem, and compare the results of both cases,
7. The possibility of solving the sand drains problem in full scale by converting it to an equivalent plane strain problem.

The following results were obtained:

1. Cam-Clay model is an efficient model to study the behaviour of normally to lightly over consolidated clayey soils,
2. The time steps used in solving the consolidation problem, can be chosen without any restrictions in case of assuming elastic behaviour. In the case of elastic-plastic behaviour the choice of time steps subjects to some restrains and conditions which must be taken into account before starting the analysis,
3. The sand drains are an efficient technique to speeding up the consolidation in soft clay in addition to increase its bearing capacity,
4. The disturbance happened in the soil during the installation of sand drains, decreases remarkably the efficiency of this technique in respect to speeding up the consolidation,
5. The radial drainage is the dominating factor on the consolidation process in sand drains problems, while the vertical drainage in the soil (excluding the vertical drainage in the sand drain columns) is negligible in this kind of problems,
6. Sand drains problems can be studied in full scale simply with acceptable precision by converting it to an equivalent plane strain problem.

Keywords : Constitutive models, critical state concept, Cam-Clay, finite element analysis, consolidation and pore water pressure.

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The undersigned certify that they have read, and recommend to the Faculty of Engineering for acceptance, a thesis entitled:

An Effective Stress Constitutive Model for Soft Clay in 3d State

Submitted by Mohammad Al-Amin Izazi in partial fulfillment of the requirements for the degree of Master of Science.

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Structural Engineering.

The work included in this thesis was carried out by the author in the Department of Structural Engineering, Ain Shams University, from 1996 to 1999

No part of this thesis has been submitted for a degree or qualification at any other university or institution.

Date : 15.12.1999

Signature :

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