

Module 3 : Method of Analyses

Lecture 11 : Introduction [Section 11.1 : An Overview]

Objectives

In this section you will learn the following

- An Overview of Method of Analyses
- Different method of Analysis
- Theorems

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INTRODUCTION

Partly for the simplicity in practice and partly because of the historical development of deformable of solids, the problems of soil mechanics are often divided into two distinct groups – the stability problems and elasticity problems. The stability problems deal with the conditions of ultimate failure of mass of soil. Problems of earth pressure, bearing capacity, and stability of slopes most often are considered in this category. The most important feature of such problems is the determination of the loads which will cause the failure of the soil mass. Solutions of these problems are done using the *theory of perfect elasticity*. The elasticity problems on the other hand deal with the stress or deformation of the soil where no failure of soil mass is involved. Stresses at points in a soil mass under the footing, or behind a retaining wall, deformation around tunnels or excavations, and all settlement problems belong to this category. Solutions to these problems are obtained by using the *theory of linear elasticity*.

Intermediate between the elasticity and stability problems are the problems mentioned above are the problems known as *progressive failure*. Progressive failure problems deal with the elastic- plastic transition from the initial linear elastic state to the ultimate failure state of the soil by plastic flow. The following section describes some of the methods of analysis which are unique with respect to each other.

11.1 DIFFERENT METHODS OF ANALYSIS

There are basically four methods of analysis:

- Limit Equilibrium.
- Limit Analysis.
- Method of Characteristics.
- Finite Element / Discrete Element Method.

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THEOREMS

There are two theorems which are used for the various analyses. Some follow one theorem while some methods of analysis follow the other. They are the upper bound and the lower bound theorems.

- In the **Upper bound theorem** , loads are determined by equating the external work to the internal work in an assumed deformation mode that satisfies:
 - Boundary deformation pattern.
 - Strain and velocity compatibility conditions.

These are kinematically admissible solutions. This analysis gives the maximum value for a particular parameter.

- In the **Lower bound theorem** , loads are determined from the stress distribution that satisfies:
 - Stress equilibrium conditions.
 - Stress boundary conditions.
 - Nowhere it violates the yield condition.

These are statically admissible solutions. This analysis gives the minimum value for a particular parameter.

However by assuming different failure surfaces the difference between the values obtained the upper and lower bound theorems can be minimized.

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Recap

In this section you have learnt the following

- An Overview of Method of Analyses
- Different method of Analysis
- Theorems

Congratulations, you have finished Lecture 11. To view the next lecture select it from the left hand side menu of the page