CE394M Advanced Analysis in Geotechnical Engineering: FEM

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January 17, 2019

Overview

Finite Element Analysis

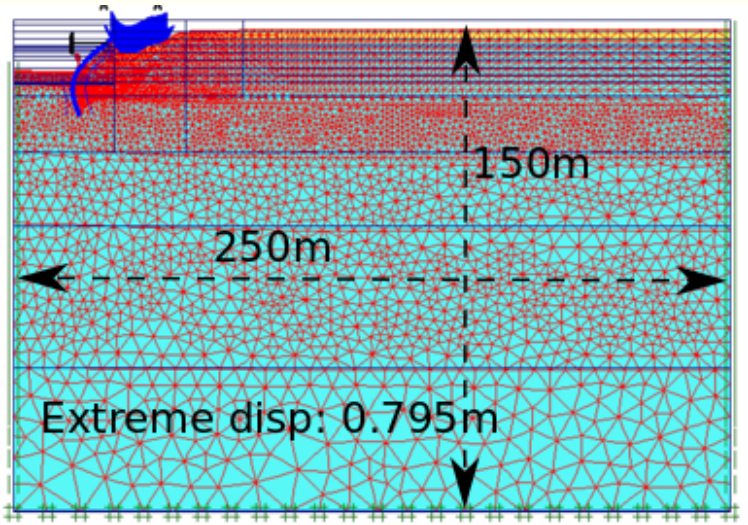


Fig. FE Mesh

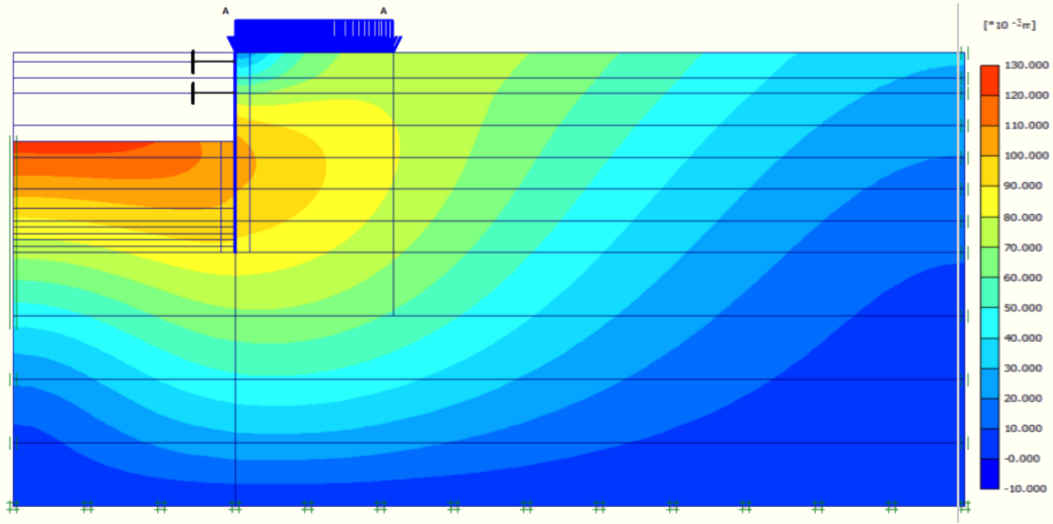


Fig. Displacement profile

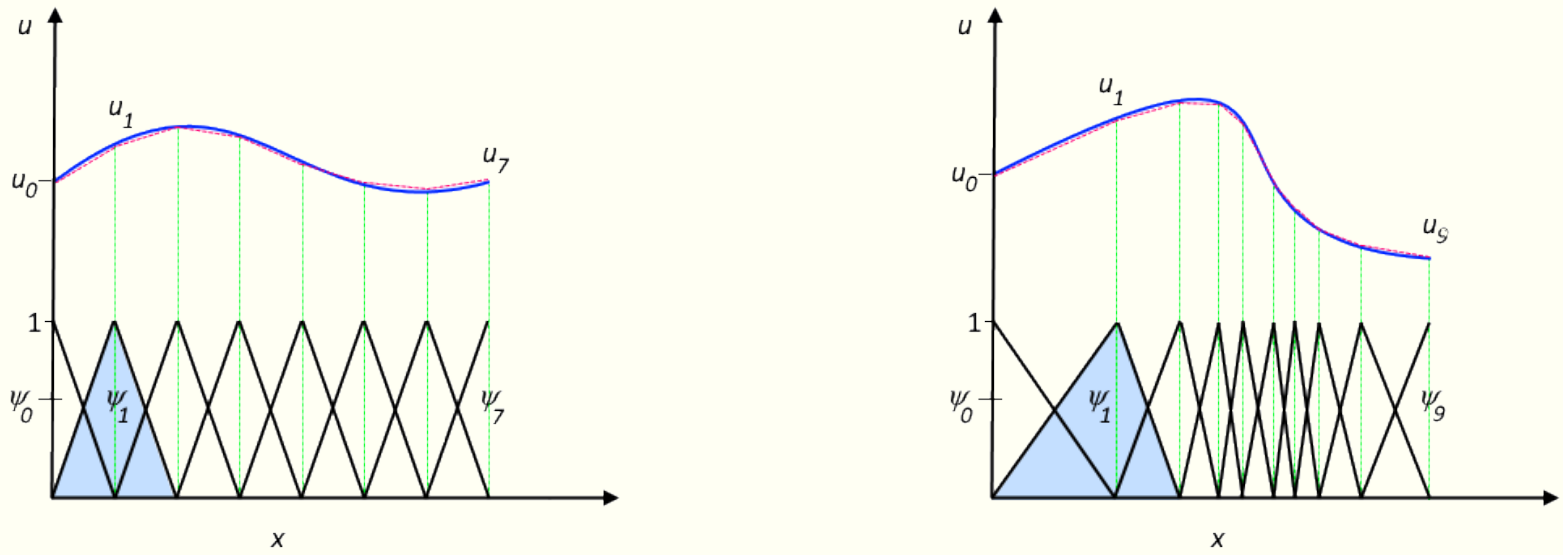
Singapore Nicoll highway excavation FE analysis

Galerkin:Ritz method

1. Define the functional u for which you wish to find stationary points.
2. Choose a combination of linearly independent functions that will be used to approximate the solution. These will be called 'basis functions'. The amplitudes of these functions will be the unknowns that you will determine. The basis functions must satisfy the Dirichlet ('fixed') boundary conditions.
3. Insert the approximate solution into the functional that is now denoted by u_h.
4. Take the directional derivative of u_h with respect to the unknown amplitudes of the basis functions.
5. Determine the amplitudes of the basis functions which yield a stationary point of u_h.

Finite Element Approximations

FE approximation of u, which is a dependent variable in a PDE.



FE basis functions

The function u can be approximated by a function u_h using linear combinations of basis functions according to the following expressions:

$$u \approx u_h \quad u_h = \sum_i u_i \psi_i$$