CE394M Advanced Analysis in Geotechnical Engineering: FEM

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Overview

Finite Element Analysis

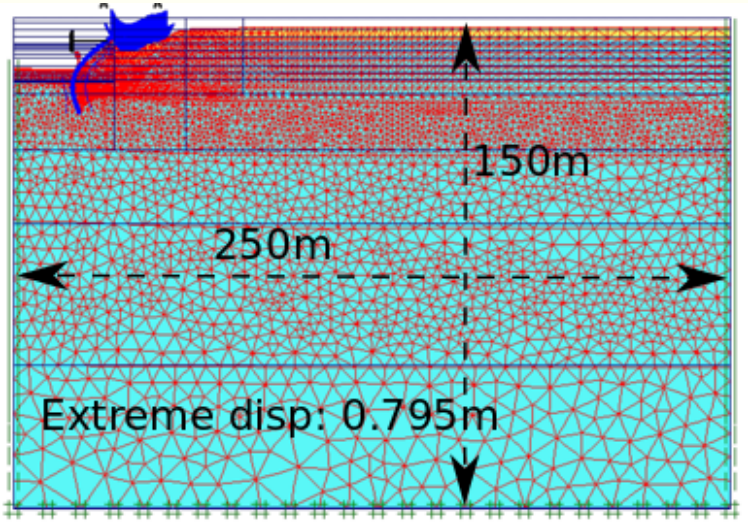


Fig. FE Mesh

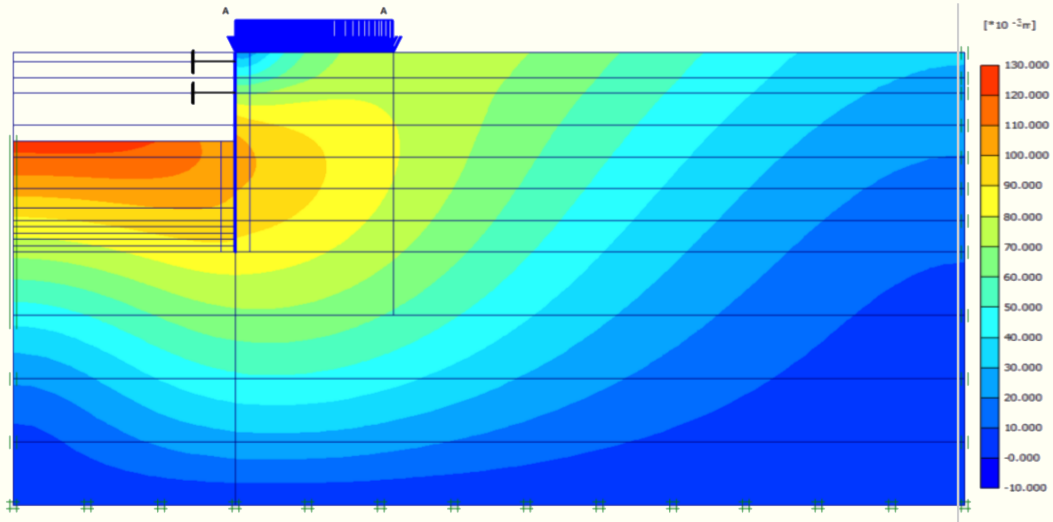


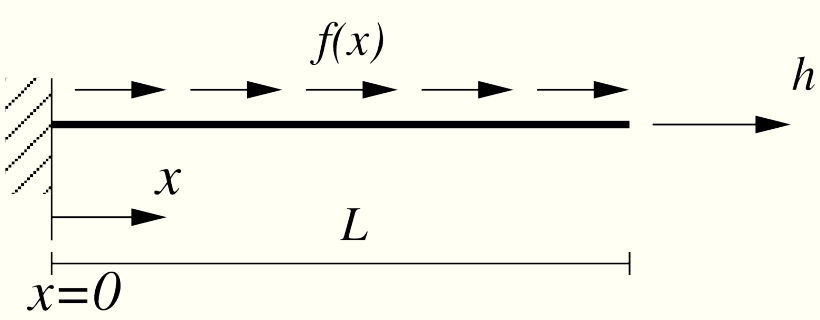
Fig. Displacement profile

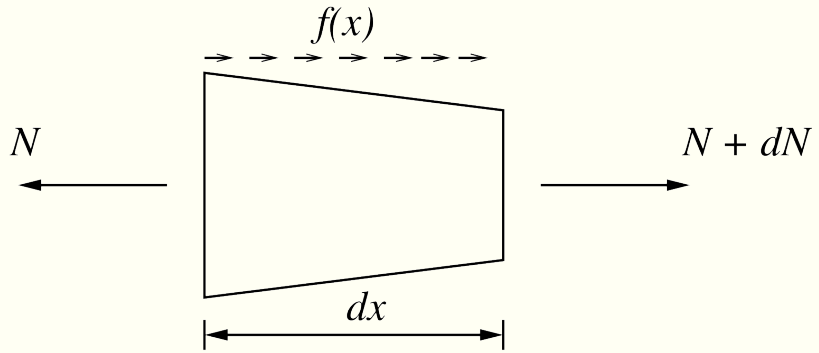
Singapore Nicoll highway excavation FE analysis

Galerkin:Ritz method

Finite Element Approximations

Strong form of the equilibrium equation for a 1-D bar





where f is a distributed force and h as a force applied at the end of the bar

The equilibrium equation can be derived by considering an infinitesimal bar:

where N is the normal force in the bar and f is the distributed force along the bar.

Boundary value problem of a 1-D bar

For linear elasticity

where $A(x)$ is the area of the bar, $E(x)$ is Young's modulus u is the displacement and $\varepsilon = du/dx$ is the strain.

which is a second-order differential equation. BCs: