CE394M: Advanced Analysis in Geotechnical Engineering

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Overview

1. Geotechnical modeling
   - Complexity in Geotechnical modeling

2. Numerical methods for differential equations
   - Direct method

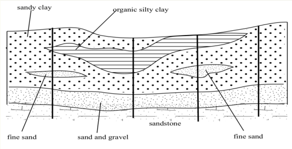
Geotechnical modeling of the complex world

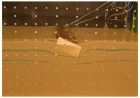
Fig. London Bridge Station, London, UK

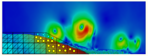
Geotechnical modeling of the complex world

Fig. London Victoria station upgrade, London, UK

Geotechnical modeling





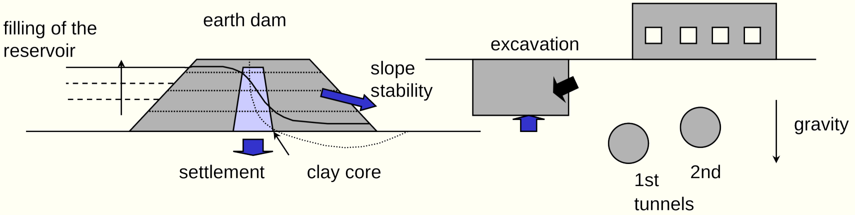


Soil behavior

- nonhomogeneous,
- anisotropic,
- non-linear,
- initial stress conditions,
- stress history
- Geometry - very complex

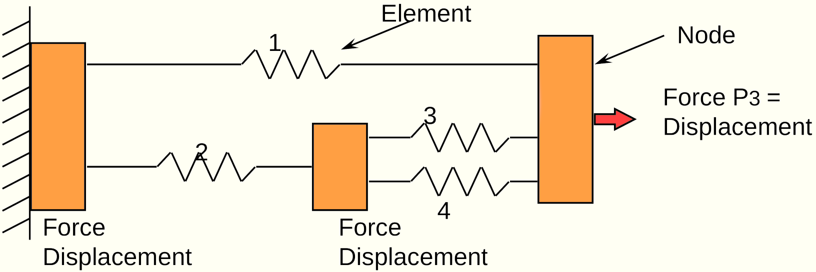
Soil Mechanics in practice - largely empirical

Geotechnical modeling: What should be modeled?



Analysis of engineering problems

Matrix analysis of structures



- What are the known variables?
- What are the unknowns?
- What do we know?

Matrix analysis of structures: Equilibrium

- $P_1 =$
- What are the unknowns?
- What do we know?

Matrix analysis of structures: Compatibility

Matrix analysis of structures: Compatibility

$v =$ internal spring distortion $\delta =$ nodal displacement

- $v_1 =$
- $v_2 =$
- $v_3 =$
- $v_4 =$

Matrix analysis of structures: Physical condition

Force-distance relationship: spring constant

spring #	1	2	3	4
stiffness ($F.L^{-1}$)	3	2	1	2

Combine all the equations: $\mathbf{P} =$
where $\mathbf{K} =$