Piles in Liquefied Soils

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Outline

1. Formulation
   - One Slide

2. Examples
   - Seismic Behavior of Horizontal Grounds
   - Seismic Behavior of Sloping Grounds
   - Piles in Liquefying Soils

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Formulation and the Implementation

- Fully coupled $u - p - U$ formulation and 3D implementation
- Physical, velocity proportional damping from solid–fluid interaction (not using Raleigh damping)
- Accelerations of pore fluid not neglected
- Formulation and implementation verified on a number of available closed form solutions
- Stable implementation for near incompressible (physical) pore fluid
- Dafalias Manzari (2004) material model used
- Single set of elastic–plastic parameters for all stages of loading (self weight, shaking, dissipation)
Level Ground, Dense Sand
Level Ground, Loose Sand

- Seismic Behavior of Horizontal Grounds
- Seismic Behavior of Sloping Grounds
- Piles in Liquefying Soils

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Modeling and Simulations of Liquefied Soils
Sloping Ground, Dense Sand

Formulation
Examples
Summary
Seismic Behavior of Horizontal Grounds
Seismic Behavior of Sloping Grounds
Piles in Liquefying Soils

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Modeling and Simulations of Liquefied Soils
Sloping Ground, Loose Sand
Bridge Pier–Pile Model

Formulation

Examples

Summary

Seismic Behavior of Horizontal Grounds

Seismic Behavior of Sloping Grounds

Piles in Liquefying Soils

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Modeling and Simulations of Liquefied Soils
Bridge Pier in Level Ground

Case I

Case II

Case III
Bridge Pier in Sloping Ground

Case IV

Case V

Case VI

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Modeling and Simulations of Liquefied Soils
Verification: the process of determining that a model implementation accurately represents the developer’s conceptual description and specification. Mathematics issue. Verification provides evidence that the model is solved correctly.

Validation: The process of determining the degree to which a model is accurate representation of the real world from the perspective of the intended uses of the model. Physics issue. Validation provides evidence that the correct model is solved.

Prediction: use of computational model to foretell the state of a physical system under consideration under conditions for which the computational model has not been validated.