Critical State Soil Mechanics Revisited: Fabric Effects

Fact Sheet

Project Information

SOMEF
Grant agreement ID: 290963
Status
Closed project
Start date 1 March 2012
End date 28 February 2018
Funded under FP7-IDEAS-ERC
Overall budget €1,924,000
EU contribution €1,924,000
Hosted by NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA Greece

Objective

The theory of Critical State Soil Mechanics (CSSM) has become a paradigm within the framework of which elastoplastic soil constitutive models have been developed for the last 50 years. The present project will constructively challenge this paradigm from a missing fundamental perspective, namely the effect of soil fabric on the premises of CSSM.

The current CSSM postulates that at critical state the stress and void ratios reach critical values with no reference to orientational aspects of the soil fabric, such as particles long axes, contact normals or void vectors statistical orientations. Thus, several soil mechanical response characteristics associated with fabric anisotropy cannot be adequately or even correctly described within the existing theory. The hypothesis that an evolving soil fabric tensor must also acquire a critical value for critical state to occur will be investigated by theoretical, numerical and experimental means, including continuum and discrete elements methods (DEM) of analysis for modeling the soil fabric.
cohesive and cohesionless soils, X-ray Computed Tomography studies on real soil samples, and triaxial, biaxial and hollow cylinder experiments. The results of this investigation will be used to propose a new enhanced CSSM theory with fabric playing a distinct role. Particular tasks will include the derivation of an objective rate equation of evolution of the fabric tensor, the formulation of classes of constitutive models for sands and clays within the new fabric-enhanced framework of CSSM, and the Finite Elements analysis of selected geomechanics boundary value problems illustrating the effect of soil fabric by comparing the results with and without fabric effects.

Successful completion of this project will change the way Soil Mechanics is taught at Universities and applied in advanced analysis of geomechanics problems, a field of increasing social impact in regards to hazard mitigations related to earthquakes and landslides.

Field of science

/natural sciences/physical sciences/theoretical physics/particles
/medical and health sciences/clinical medicine/radiology/medical imaging/computed tomography

Programme(s)

Topic(s)

Call for proposal

ERC-2011-ADG_20110209

Funding Scheme

ERC-AG - ERC Advanced Grant

Host institution

NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA

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## Beneficiaries (4)

### UNIVERSITE JOSEPH FOURIER GRENOBLE 1
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- **Activity type**: Higher or Secondary Education Establishments
- **Website**
- **Principal investigator**: Ioannis Dafalias (Prof.)
- **Administrative Contact**: Georgia Mertzelou (Ms.)

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CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS

France

EU contribution

€ 78 000

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Activity type

Research Organisations

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Contact the organisation

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