Introduction to advanced numerical methods for particulate media
Introduction to advanced numerical methods for particulate media

Module number SE-O-16	Credits 3 CP	Workload 90 h	Semester[s] 3. Sem.	Duration 1 Semester[s]	Group size no limitation
Courses a) Introduction to advanced numerical methods for particulate media			**Contact hours** a) 2 WLH (30 h)	**Self-study** a) 60 h	**Frequency** a) each winter

Module coordinator and lecturer(s)

Prof. Dr.-Ing. Torsten Wichtmann

a) Dr.-Ing. Mohammad Salimi

Admission requirements

Recommended previous knowledge:

completed module in Numerical Simulation in Geotechnics

Learning outcome, core skills

After successfully completing the module, students will be able to:

- Understand DEM fundamentals and applications
- Implement particle and boundary modeling techniques
- Apply force models and contact detection schemes
- Utilize time integration methods
- Comprehend DEM's strengths and limitations
- Develop basic DEM code for triaxial test simulations
- Apply DEM to real-world geotechnical engineering problems

Contents

a)

This course introduces the Discrete Element Method (DEM), a powerful computational technique for analyzing particulate materials in subsurface engineering. The lecture contents cover the following topics:

1. Foundations of Computational Methods
2. Theoretical Fundamentals
3. Computational Aspects
4. Soft Sphere Approach in Detail
5. Damping Mechanisms
6. Stress Analysis in DEM
7. Strain and Measurable Quantities
8. Forces and Torques
9. Advanced Contact Models
10. Non-Spherical Particle Shapes
11. Boundary Conditions
12. Model Validation and Calibration
13. Servo Mechanisms and Scaling
14. Advanced Forces and Torques
15. DEM in Practice

The course emphasizes physical understanding over programming details, using easy-to-follow slides and practical examples. This course provides a foundation for those interested in pursuing advanced topics in computational methods for particulate media.

Educational form / Language

a) Lecture (2 WLH) / English

Examination methods

• Term paper 'Introduction to advanced numerical methods for particulate media' (60 h., Part of modul grade 100 %, deadline will be announced at the beginning of the semester)

Requirements for the award of credit points

  • Successful completion and presentation of the final project

Module applicability

  • M.Sc. Subsurface Engineering
  • M.Sc. Civil Engineering
  • M.Sc. Computational Engineering

The skills and knowledge gained in this course are transferable to various fields dealing with particulate media and computational modeling.

Weight of the mark for the final score

Percentage of total grade [%] = 3 * 100 * FAK / DIV

FAK: The weighting factors can be taken from the table of contents.

DIV: The values can be taken from the table of contents.

Further Information