

POSEIDON – MSCA DN: DC03
**UNIVERSITY
OF TWENTE.**

PhD Project Title: Understanding the influence of grain morphology and mesostructure on the initiation and runout of submarine landslides

Enrolment in Doctoral degree(s): University of Twente

Supervisors: prof. V. Magnanimo and dr. Hongyang Cheng

Recruitment host: University of Twente

Secondment host: Dr. Nallathamby Sivasithamparam (Norwegian Geotechnical Institute),
Dr. Michele Larcher (Free University of Bolzano)

Background and aim:

Hydromechanical phenomena at the pore scale, such as the development of elevated water pressure, and how they are coupled to the soil's mesostructure, are key to the initiation and runout of submarine landslides. The fact that different regimes, e.g., quasi-static or fast-flowing, of the coupled particle-fluid systems interplay with the material's particle- and meso-scale structures makes the prediction of submarine granular flows, from initiation to run-out, a scientific as well as a practical challenge.

Fully-resolved simulations of particle-fluid systems can be used to study the macroscopic behaviour of saturated granular materials. The effects of particle shapes and the mesostructure on the hydrodynamic coupling to the pore fluid can all be investigated with the coupled Lattice Boltzmann-Discrete Element Method.

We **aim to develop a hydro-micromechanical** model of realistic granular soils using fully-resolved direct numerical simulation techniques, focusing on representative volume elements (RVEs). The goal is to understand the role of grain morphology and mesostructure in the avalanching and resting processes during submarine landslides, at various overpressure conditions.

Objectives:

- i) Apply an existing LBM-DEM numerical model to simulate the collapse of dense/loose granular masses over an inclined plane subjected to sudden increase of pore pressure;
- ii) Incorporate realistic particle shapes in the LBM-DEM model and study the effect of grain morphology hydromechanical behaviour at NGI;
- iii) Compare and validate the simulations at point i) and ii) with the pilot-scale laboratory experiments on granular–liquid mixtures at the Free University of Bolzano;
- iv) Coarse grain particle scale information into continuum fields and understand the mass/momentum transfer and energy dissipation mechanisms that contribute to the triggering and runout of saturated granular flows.

Expected Results:

- i) A novel hydro-micromechanical numerical tool for modelling saturated granular masses in submarine landslides;
- ii) A deep understanding of the interplay between structural properties (e.g., morphology and mesostructure) and pore water pressure on the saturated granular flows.

Your Profile:

The ideal candidate should:



- Obtained a MSc degree in a relevant field such as civil engineering, mechanical engineering, computational physics, applied mathematics, materials science, or related areas;
- Good knowledge of fluid-coupled particulate systems in slow and/or fast motion;
- Sound programming skills in C/C++, Fortran, Python or equivalent;
- Experience with the discrete element method or other particle-based numerical methods would be advantageous;
- You are an excellent teammate, able to collaborate intensively with industrial and academic parties in regular meetings and work visits;
- An appropriate qualification in the English Language together with excellent communication and organizational skills

Planned Secondment(s):

Dr. Nallathamby Sivasithamparam (NGI, 6 months): integrate particle shape within LBM-DEM.

Dr. Michele Larcher (Free University of Bolzano, 3 months): perform experiments in the inclined channel experimental device on dense/loose granular slopes and compare with simulations.

Information and application

Please submit your application before **February 28, 2024** via the following application link:

<https://utwentecareers.nl/en/vacancies/1606/13-phd-positions-on-the-eu-horizon-2020-marie-skiadowska-curie-project-poseidon/>

Submission must include:

- **Cover Letter:** A maximum of two A4 pages, highlighting your specific interest in the position, your qualifications, and motivations for applying. This letter should clearly articulate how your background and experiences align with the requirements of this project
- **Detailed Curriculum Vitae (CV):** The CV, should include, if applicable, a list of publications;
- **Bachelor and Master transcripts;**
- **Contact Details of Referees:** Provide the names and contact information of individuals who can professionally vouch for your qualifications and suitability for this position.

For general inquiries on the application procedures and the consortium please contact: info@poseidon-dn.eu