Contribution ID: **433** Type: **Oral Presentation**

Numerical yield surface determination of cemented rocks from digital microstructures

Tuesday, 1 June 2021 11:15 (15 minutes)

Cemented granular materials is a general class of geomaterials composed of grains connected by cement partially or completely filling the void in-between the grains. After deposition and consolidation phases of the sediments, cementation happens during diagenesis when mineral matter precipitates at the pore-grain interface. This process is known to increase the strength of the geomaterial by creating a cohesion between the particles. As such, it is critical to characterize for material stability applications in geotechnical engineering and geophysical processes. However, no quantitative law can be directly derived between the amount of cement and rock strength because cementation depends heavily on the rock microstructure and the initial distribution of chain forces. On top of that, this process takes place at a geological timescale, which makes it complicated to reproduce experimentally. Eventually, only direct numerical simulation of elasto-plasticity performed at the micro-scale level and coupled with microstructure evolution can be used to determine the strength of cemented materials. In this study we provide for the first time a comprehensive parametric study on the impact of cementation on rock strength for real microstructures of granular materials. Compared to most previous studies, the whole yield surface is determined numerically in order to assess the influence of cementation for different stress-paths. The previously known tendency of rock to strengthen with increasing cementation volume is verified. New results on the influence of cement property namely Young's modulus, friction and cohesion on the rock's yield surface are explored. While most studies use Discrete Element Modelling to consider grain contacts explicitly, our simulator uses Finite Element Modelling which allows more flexibility in the approach to model the precipitation of the pressure-sensitive layer of cement. The contacts are modelled as an upscaled plastic law. The framework presented in this study showcases the possibility of determining rock yield surfaces from their microstructures. While the current contribution focuses on cementation, other phenomena of interest can also be investigated such as dissolution from reactive transport.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

Acceptance of Terms and Conditions

Click here to agree

Newsletter

I do not want to receive the InterPore newsletter

Student Poster Award

Primary authors: Dr LESUEUR, Martin (University of Western Australia); Dr RATTEZ, Hadrien (Université catholique de Louvain); Dr VEVEAKIS, Manolis (Duke University)

Presenter: Dr LESUEUR, Martin (University of Western Australia)

Session Classification: MS12

Track Classification: (MS12) Advances in modeling and simulation of poromechanics