Title: Postdoctoral position in experimental and numerical characterization of shear cracks along rough interfaces

Academic Environment

The postdoctoral position is offered at Centrale Nantes, within the Research Institute in Civil and Mechanical Engineering (GeM) https://gem.ec-nantes.fr. Centrale Nantes is a top-ranking school on the international stage, producing world-class fundamental and applied research. The postdoctoral scholar will be supervised in conjunction by Vito Rubino https://www.ec-nantes.fr/m-vito-rubino and Ioannis Stefanou http://coquake.eu/index.php/group. The position is fully funded for 12 months (and can be extended up to 18 months) under the NExT Junior Talent program.

Scientific background:

Understanding the behavior of dynamic shear cracks and friction evolution is relevant for a wide range of problems in different fields, such as fiber pull-out in the failure of composite materials, bimaterial structures and adhesive joints produced using advanced manufacturing techniques for automotive, electronics and biology applications. Shear ruptures are also relevant to the study of earthquakes occurring as ruptures along faults in the Earth's crust. Interface roughness controls rupture behavior along interfaces, and it influences a broad class of rupture mechanics issues including dynamic propagation, which results in catastrophic failure.

Project description and goals

The goal of this research project is to investigate the role of roughness on shear crack propagation and friction evolution using a combined experimental and numerical approach. This project will enhance our understanding of fundamental physical processes governing failure of materials and interfaces. It will also entail the advancement of experimental and computational mechanics techniques.

More in detail, the project has the following objectives:

- Develop an advanced experimental setup featuring low to ultrahigh-speed diagnostic tools based on digital image correlation.
- Investigate the role of roughness on shear crack propagation and friction evolution using the proposed innovative experimental approach, combined with numerical simulations.
- Interpret experimental results with the aid of theory and machine learning to understand and predict the patterns of stable vs. catastrophic rupture.
- Transfer knowledge from earthquake mechanics to advanced engineering design and manufacturing.

Keywords: Fracture mechanics, Dynamic friction, Digital image correlation, Laboratory experiments

References

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- Braun P., G. Tzortzopoulos, I. Stefanou, Design of Sand-Based, 3-D-Printed Analog Faults with Controlled Frictional Properties, *Journal of Geophysical Research: Solid Earth,* 126 (5), e2020JB020520, 2021. https://doi.org/10.1029/2020JB020520

Requirements

Successful candidates are expected to have a PhD degree level in Mechanical or Civil Engineering or related disciplines and a strong background in solid/continuum mechanics. Candidates are expected to be highly motivated and have relevant experience in experimental and computational mechanics. Fluency in spoken and written English is required. French is a plus but not required. The postdoctoral scholar will carry out their research project and write scientific articles in close collaboration with their supervisors, but a good degree of independence and-self motivation is also required.

Applications

Highly-motivated candidates with the required skills should submit an application (including a CV, cover letter describing interests and qualifications related to the project, and contact details of two references) to Dr. Vito Rubino at vito.rubino@ec-nantes.fr. Tentative start date is 01/10/2023.