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# MULTI-SCALE MULTI-PHYSICS MODELLING OF QUASI BRITTLE MATERIALS DEGRADATION

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## ABSTRACT

Deterioration of quasi-brittle materials, such as concrete and rock, is a fundamental issue and its complete understanding is, to date, an open task.

When subject to increasing mechanical loads, these type of materials initially develop distributed micro-cracks, some of which then by coalescence may lead to localized macro-cracks, while the rest of the micro-cracks unload. The highly heterogeneous nature of these materials also plays a key role in the cracking process. In the last 2-3 decades, a number of models have been proposed to describe these complex mechanisms and several are currently under study. Among them classical models based on the continuum approach, smeared and discrete cohesive crack models, as well as more recent techniques such as XFEM, phase field, etc. Moreover, as previously mentioned, being these materials highly heterogeneous, multi-scale models, such as micro- or meso-mechanical models, based on the physics of microstructures have also been developed. In this way, it becomes possible to predict complex behaviour starting from simpler assumptions.

But degradation is caused by mechanical as well as environmental loadings and the effect of the latter is fundamental because of the interaction effects and the coupling of the properties of heat transport, humidity, radiation and chemical agents with the mechanical response. Therefore, for a proper understanding and assessment of the several potential degradation mechanisms that can affect these materials and act simultaneously, multi-physics sound models, that include mechanical and flow/diffusion/transport equations, are needed.

The present mini-symposium is intended to gather contributions on all those and related topics, including experimental, theoretical and numerical modeling of materials degradation, with a specific view to multi-scale and multi-physics approaches.

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