A variational approach for brittle crack propagation

G. Petraglia, P. Cornetti, A. Grillo, A. Sapora

Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino

Department of Mathematical Science, Politecnico di Torino

giacomo.petraglia@polito.it

In this work, we investigate crack path in brittle pre-cracked structures through a variational phase-field formulation for fracture. Accordingly, crack nucleation and propagation rise from the minimization of an energy functional incorporating a regularized description of fracture dissipation. The model is implemented within a quasi-static setting, assuming rate-independent behavior, and it is solved numerically via finite element discretization. Energetic consistency is ensured by the underlying variational structure.

Numerical results are validated against experimental data available in the literature related to compact tension and double cantilever beam geometries. Numerical predictions are in good agreement in terms of both critical loads and crack propagation. Finally, in order to further corroborate the model, the stress apporach in the framework of Theory of Critical Distances is implemented, considering a curved crack onset. Results are discussed and future research steps are highlighted.