Math SOMMa Junior Meeting
2-4 October 2024, Centre de Recerca Matemàtica, Barcelona

Phase-field damage models via homogenization – SOMMa 2024

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ABSTRACT

Phase-field method has become during the last two decades a powerful approach to successfully solve problems related to fracture mechanics. However, the theory still presents some limitations including unclear analytical degradation and dissipation functions and computational efficiency.

In fact, the effect of damage on the strain energy function has been habitually computed with analytical degradation functions. In this work, we propose to understand the degradation function as the homogenization of a microstructure with a void inclusion. Thus, we replace the phase field variable by microstructure parameters. Through this, we automatically obtain an orthotropic homogenized constitutive tensor which is also supported by a physical phenomenon instead of depending on ad-hoc analytical expression.

The methodology implemented consists of two stages: (1) an offline stage where the mechanical response (constitutive tensor) of the microstructure has been computed for different void parameters and (2) a second stage where the structural damage simulation is computed.

Different results have been obtained from benchmark tests to validate the formulation and the computation cost has been compared with standard phase field approach.