Computational Mechanics Group
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Topic proposal

Coupling bulk and interface fracture in a computational framework

Many common materials, including concrete, biological tissues, fiber-reinforced composites, and particle-reinforced ceramics, are composed of two or more brittle or quasi-brittle phases that mechanically interact through interfacial zones. In these materials, the interplay between bulk fracture and interface decohesion determines the macroscopic fracture behavior.

Numerically, fracture in the bulk (where the crack path is not known a priori) is best described with the phase-field approach. The description of Interface decohesion with the same approach, while possible, is computationally expensive; moreover, the expense is not justified since for this phenomenon the crack path is known a priori. The proposed project aims at implementing, in an in-house finite element code, a new framework that couples a phase-field approach to describe the fracture behavior in the bulk and a cohesive zone approach to describe decohesion along the interfaces. The method will be tested using various numerical experiments inspired by the available literature and regarding the propagation of cracks in layered biological and polymeric soft materials.

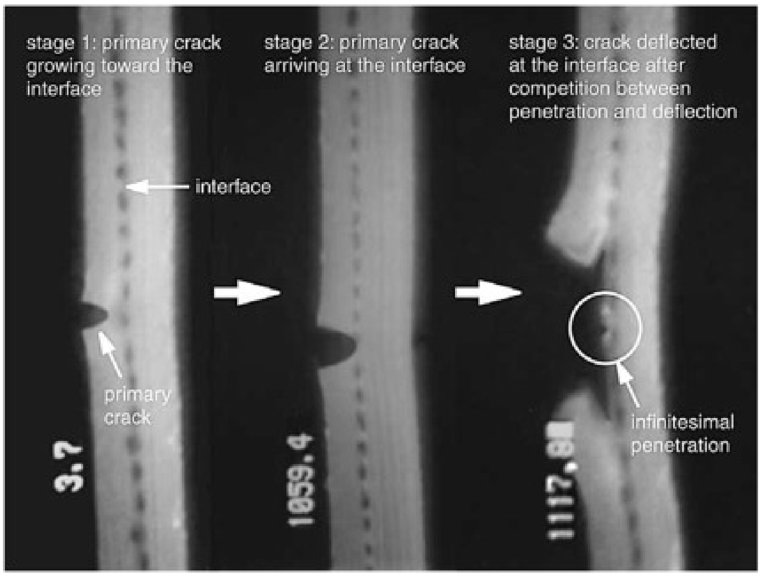

Figure*: Crack propagation in a layered soft material.

*Source: Lee et al. (2004), *Reconsideration of crack deflection at planar interfaces in layered systems*, Composites Science and Technology, 64:2415–2423.

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