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Abstract title:

Coupling friction and surface debonding in an interface cohesive model
Abstract
Coupling friction and surface debonding in an interface cohesive model

By Irene Guiamatsia and Giang D. Nguyen
The University of Sydney, School of Civil Engineering.

Failure develops and propagates through a structure via a complex sequence of competing micro-mechanisms occurring simultaneously. While the active mechanism of surface debonding is the source of loss of stiffness and cohesion, friction between cracked surfaces, upon their closure, acts as a passive dissipation mechanism behind the quasi-brittleness and hence can increase the toughness of the material under favorable loading conditions. In order to numerically study damage propagation, the constitutive response must be able to faithfully capture, both qualitatively and quantitatively, one of the signature characteristic of failure: the energy dissipation.

In this paper, we present an interface decohesive model for discrete fracture that is capable of capturing:

- the coupling between damage (loss of stiffness) and plasticity (permanent deformation) when the normal component of the traction at the interface is positive.
- The coupling between damage (loss of stiffness) and friction (slip of opened microcracks) when the normal component of the traction at the interface is negative, causing frictional loss at the microcracks.

Under continuous loading, the model seamlessly progresses from modelling the debonding of the interface to modelling the post-debonding frictional loss between the newly created surfaces. This constitutive model is then used to successfully predict the response of realistic engineering structures under generalized loading conditions as demonstrated with several numerical examples.
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