A frictional interface model for the propagation of cohesive fracture under cyclic loading

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The paper presents an extension of a recent presented mechanical interface model, [1-2], for the description of the smooth cohesive/frictional transition along potentially active cohesive fracture surfaces.

The model presented includes the description of internal frictional dissipative mechanisms which are active under combined compressive/sliding loading in either the cohesive process zone, or in the fully fractured interface portion. Moreover, always under compressive/sliding loading conditions, frictional dissipation mechanisms can also develop in the undamaged (or sound) portion of the interface, justified by the circumstance that also at the virgin state in the bonding surface are present initial defects (stable micro-fracures or microvoids) which might generate friction.

The main features of the proposed model may be better understood considering deformation mechanisms involved in the interface layer of finite thikness analyzed at the microscale level, i.e. by investigating the microstrural response of an heterogeneous damageable thin layer. Mechanical information passages from the microscale response to the macro interface constitutive relations are investigated in a multiscale point of view.

The interface, zero thickness, constitutive model has been implemented in a FE environment and specific nonlinear numerical response are reported for cyclic loading, as well as for monotonic increasing loading.

Finally, it will be shown as the model is able to reproduce the cyclic response and the progressive fracture propagation, also in the case of high number of low constant amplitude cyclic loading. The high number cyclic failure is shown to be promoted by the internal friction mechanisms which induces a further low-intensity damage development in the cohesive zone and then fatigue-type failure. The numerical response obtained with the proposed model is also compared with corresponding experimental data.

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References

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