A cohesive zone model embedded in a thin softening layer:

the CZM-TLS model

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ABSTRACT

When it comes to fracture, the cohesive zone model (CZM) is a powerful way to incorporate complex decohesion mechanisms on the crack interface. It has been applied to a large variety of materials. For instance, in quasi-brittle media, it was shown to predict nicely the proper size effect.

However, the CZM has some important limitations when it comes to crack growth direction (the decohesion description of the CZM does include a crack growth direction criterion) or conditions for branching. Crack coalescence is also an issue as well as the lack of triaxiality of the model, rendering crack splitting test difficult to model.

The overcome the CZM limitation, we propose to embed the cohesive zone in a thin softening bulk layer. This layer is regularized by the TLS (Thick Level Set) damage model to avoid spurious localization. The softening bulk model (SBM) takes care of driving, branching or coalescing cracks while the CZM in its core takes care of providing the displacement jump. Another interesting feature of the CZM-TLS model is that softening is limited in the bulk ensuring proper material response on the crack faces (for contact of friction for instance).

Several examples will demonstrate the powerfulness the CZM-TLS combination.

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