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# AVOIDING SPURIOUS DAMAGE LOCALIZATION WITH A NEW NON-LOCAL DAMAGE MODEL : THE THICK LEVEL SET APPROACH

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It is well known that damage models do need a length scale to avoid spurious localization (ie localization with zero dissipation). This length scale summarizes interactions between micro-cracks as localization develops. Most if not all existing damage models (non-local integral, gradient based, phase-field, variational fracture ) do introduce a fixed length scale in time and space. The downside is that numerical effort is needed all over the computational domain. Another downside of existing damage models is that the transition to fracture is not straightforward: placing a crack in the damage zone is complicate. We introduce a new way to model damage to alleviate both issues above called thick level set model for damage [2, 1]. Damage is forced to evolve as a function of the distance to an iso-zero level set. On the iso-zero level set, damage is zero and it grows to 1 the distance goes to a critical length  $l_c$ . The condition for the level set (ie damage) to initiate will be shown to be local. Also the set of fully damaged points is clearly given by the area delimited by the iso- $l_c$  level set thus unveiling a crack path. The thermodynamics setting of the new model will be presented as well as example of complex crack growth patterns in quasi-brittle media.

## References

- [1] P.-E. Bernard, N. Moës, and N. Chevaugeon. Damage growth modeling using the Thick Level Set (TLS) approach: efficient discretization for quasi-static loadings. *Computer Methods in Applied Mechanics and Engineering*, submitted.
- [2] N. Moës, C. Stolz, P.-E. Bernard, and N. Chevaugeon. A level set based model for damage growth : the thick level set approach. *International Journal For Numerical Methods in Engineering* 86: 358-380,2011.