To simulate numerically failure of quasi-brittle materials, strategies which combine damage and fracture mechanics may be employed. Since Linear Elastic Fracture Mechanics theory cannot then be used, the direction of the evolving cracks cannot be analytically derived.

In order to determine this direction, different strategies have been developed, all of them based on mechanical criteria. Here, a new strategy which is exclusively based on a geometric criterion is used. The discontinuity is propagated following the direction dictated by the $\theta$-simplified medial axis of the already damaged domain, a concept which emerged as a tool in image analysis and is widely used in the computer graphics field.

**Abstract**

**MEDIAL AXIS (MA, Blum [1967]):** loci of centres of bi-tangent interior circles

The MA gives a main path which can be used for crack propagation.

But...

- Spurious branches appear.
- It is heavily sensitive to boundary modifications.

**$\theta$-SIMPLIFIED MEDIAL AXIS ($\theta$-SMA, Foskey et al. [2003]):** points of the MA whose separation angle exceeds $\theta$

However, by means of the $\theta$-SMA (with $\theta \rightarrow \pi$):

- No spurious branches are captured.
- It is less sensitive to boundary modifications.

**Numerical Examples:** which path do the MA and the $\theta$-SMA predict?

1. Three-point bending test
2. Four-point bending test
3. Square plate under mode I loading conditions

• With the MA, too many spurious branches are observed.
• With the $\theta$-SMA ($\theta \rightarrow \pi$), the crack path may be predicted. Even branching is captured.

**Concluding Remarks:**
