Microplane Model with Relaxed Kinematic Constraint in the Framework of Micro Polar Cosserat Continuum

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ABSTRACT

Modeling materials which exhibit cracking and damage phenomena in the framework of standard continuum together with standard finite elements leads to results that are mesh-dependent. In the present contribution microplane model with relaxed kinematic constraint is formulated in the framework of higher order Micro Polar Cosserat continuum and combined with the regularization based on the energy (crack band method).

Similar as for the standard continuum, the non-symmetric macroscopic strain tensor is on each microplane decomposed into volumetric, deviatoric and shear component (V-D-T split). The model is characterized by the two length scales, torsional and bending, that for dominant shear stress-strain state assure objectivity of the results with respect to the discretization.

The model is implemented into a 3D finite element (FE) code and first verified on a simple layer of finite elements loaded in shear. Subsequently, 3D FE analysis is carried out for typical concrete applications: simple shear, uniaxial compression, 3-point bending of pre-notched beam and the mixed-mode crack propagation performed on a single-edge-notched beam specimen. It is demonstrated that the higher order micro polar Cosserat continuum in combination with the crack band method leads to the results that are independent of the spatial discretization.

REFERENCES

[1] J. Ožbolt and S. Gambarelli, "Microplane model with relaxed kinematic constraint in the framework of micro polar Cosserat continuum", *Engineering Fracture Mechanics*, 199, 476-488, (2018).