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MESOSCOPIC MODEL OF DISLOCATIONAL PLASTICITY ACCOUNTING FOR CRYSTAL SYMMETRY

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For micro and nano sized samples the dislocation-mediated crystal plasticity is radically different from the one described by classical engineering theory. At the microscale, plasticity evolves in a chaotic manner through a sequence of intermittent events involving collective motion of dislocations and their interaction with existing crystal defects. Detailed mathematical modeling of these processes remains a major challenge for materials science. In this work, we present a mesoscopic post-DDD approach that involves constructing a coarse-grained non-convex energy which poses GL(2,Z) group symmetry [1, 2]. Our approach is capable of describing inherent lattice structure and is largely free of arbitrariness when one deals with the fast topological changes in dislocations configurations such as nucleation, annihilation, interaction with obstacles and various other entanglements [3].

REFERENCES

[1] Engel, Peter *Geometric crystallography: an axiomatic introduction to crystallography.* Springer Science & Business Media (2012).

[2] Bhattacharya, Kaushik and Conti, Sergio and Zanzotto, Giovanni and Zimmer, Johannes. Crystal symmetry and the reversibility of martensitic transformations. *Nature* (2004) **428**, (6978), pp.55–59, University of Bath.

[3] Conti, Sergio and Zanzotto, Giovanni. A variational model for reconstructive phase transformations in crystals, and their relation to dislocations and plasticity. *Archive for rational mechanics and analysis* (2004) **173**, (1), pp.69–88, Springer.