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Atom dislocation in crystals: nonlocal effects and connections with dynamical systems

Abstract:
We consider an evolution equation arising in the Peierls-Nabarro model for crystal dislocation. We study the evolution of such dislocation function and show that, at a macroscopic scale, the dislocations have the tendency to concentrate at single points of the crystal, where the size of the slip coincides with the natural periodicity of the medium. These dislocation points evolve according to the external stress and an interior potential.

According to the mutual orientation of the dislocations, this potential is of either repulsive or attractive type, and in the latter case collision phenomena may occur. Though the problem is derived from a classical model in materials science, the leading order of the diffusion turns out to be a nonlocal integrodifferential operator.

We also consider the perturbed stationary equation, constructing solutions of heteroclinic, homoclinic and multibump type.

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