# Existence result to the rate type fluid model arising form crystal plasticity

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**Abstract**

Looking at severe plastic deformation experiments, it seems that crystalline materials at yield behave as a special kind of anisotropic, highly viscous fluids flowing through an adjustable crystal lattice space. The flow through the lattice space is restricted to preferred crystallographic planes and directions causing anisotropy. In the deformation process the lattice is strained and rotated.
The derivation of a model is based on the rate form of the decomposition rule: the velocity gradient consists of the lattice velocity gradient and the sum of the velocity gradients corresponding to the slip rates of individual slip systems. We employ the Gibbs potential to obtain rate-type stress-strain constitutive response.

We propose a new regularisation to the stress evolution equation. Using the energy estimates we prove global in time existence of a weak solution by the Galerkin method in two space dimension. We apply the tensorial version of the logarithmic Sobolev inequality.
The considered crystal plasticity model allowing for large deformations is treated as the flow-adjusted boundary value problem. As a test example we analyse a micropillar compression. We propose finite element scheme for a numerical solution in the Arbitrary Lagrangian Eulerian (ALE) configuration.

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