ABSTRACT

The residual stress state of formed components has a significant influence on their life-time behavior. Up to now, basic knowledge regarding the development and the targeted use of forming induced residual stresses does not exist. Our aim is to investigate on different scales the formation of residual stresses during forming processes and the life-time stability during the operational time of the formed components.

Non-integrable strains generated by an inhomogeneous plastic deformation are the reason for residual stresses [1]. Therefore, the computation of geometrically necessary dislocation (GND) densities in multiplicative plasticity lead to indicators of residual distortions (and thus stresses) for macroscopic forming simulations, see Fig. 1.

Microscopically, we uncover mechanisms regarding the formation and the stability of residual stresses by using crystal plasticity finite element simulations. Thereby, dislocations from macroscopic forming simulations at specific integration points are exploited as boundary conditions for micro-simulations based on representative volume elements (RVE).

REFERENCES