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A Micromechanical Model for Single-Crystal Shape-Memory-Alloys

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We developed a continuum-mechanical model for shape-memory-alloys which utilises only physically well defined quantities. Therefore we define an averaged energy density of a representative volume element (RVE) which can consist of austenite and several variants of martensite. Instead of using a homogenous strain-state for the whole RVE, that would lead us to a non-convex problem, we apply a certain microstructure by separating the RVE into different regions, called laminates, which consist of one of the phases. We obtain new variables, where some of them will be considered as minimizers of the averaged energy density. This minimization process will define a relaxed energy functional. All remaining variables are related to dissipative energy terms because we want to simulate the characteristic hysteretic behaviour. For that reason we can derive evolution equations from the least-action principle. We verifiy the algorithm in a material-point computation and apply it to the FEM.

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