**Title:** Modeling of phase transformations in shape memory materials

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**Abstract:** This thesis presents a new thermomechanical three-dimensional constitutive model of NiTi-based shape memory alloys. The model was formulated within the framework of generalised standard models and it features a novel form of the dissipation function, which combines contributions stemming from the phase transformation between austenite and martensite and from the reorientation of martensite. The change in the material response associated with the phase transformation between austenite and R-phase as well as material anisotropy and tension-compression asymmetry are also covered. The time-evolutionary problem of a quasistatic mechanical loading of a NiTi body with prescribed temperature evolution was formulated and analyzed within the framework of energetic solutions. The corresponding time-incremental minimization problem provided a conceptual algorithm utilized in the numerical treatment. The constitutive model was implemented into the finite element package Abaqus. Several numerical simulations were performed and compared with experiments.

**Keywords:** shape memory alloys, constitutive model, generalized standard models, martensitic phase transformation