Thermo-magneto-mechanical Modeling for Martensitic Variant Reorientation in Ferromagnetic Shape Memory Alloys

Han, Y., Du, H., Wang, L., Melnik, R.

Journal publication, 2022.

Abstract

The paper presents a 2D phenomenological model to characterize the thermo-magneto-mechanical coupled behaviour for martensitic variant reorientation in ferromagnetic shape memory alloys. The Landau free energy function is employed to account for the hysteretic nonlinearity in the reorientation of martensitic variants. A set of state variables are chosen to describe different microscopic mechanisms, and the evolution rules of the state variables are determined via the Lagrange equation. To validate the model capability, the model formulation is numerically implemented for the typical loading condition (i.e. uniaxial stress and a perpendicular magnetic field). Model predictions are compared with experimental results, and good correlations demonstrate the magneto-mechanical coupling capacity of the model as well as its temperature-dependent nature.

==