MS1S_12016

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Study of Non-Linear Magnetomechanical Constitutive Relations of Ferromagnetic Materials

Daining Fang, Xue Feng, Yongping Wan, Keh-Chih Hwang

Department of Engineering Mechanics, Tsinghua University, Beijing, China

In this investigation, both experimental and theoretical study on developing nonlinear magnetomechanical constitutive relations of ferromagnetic materials is performed. A novel magnetomechanical testing setup and the measurement techniques, which were developed for the measurement of the nonlinear magnetomechanical response of both magnetostrictive and soft ferromagnetic materials subjected to coupled magnetomechanical loading, are introduced. The detailed experimental results are presented and discussed. a general constitutive relation for ferromagnetic and magnetostrictive materials, based on the internal variable theory, is developed. A non-quadratic magneto-mechanical yield surface is introduced for both isotropic and anisotropic materials. The macroscopic features of ferromagnetic materials, such as hysteresis loop, magnetostrictive, magnetostrictive hysterisis, can be predicted. The calculated results are consistent with the experimental data well.

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