

Disorder Identification in Hysteresis Data: Recognition Analysis of the Random-Bond-Random-Field Ising Model

Author(s): Ovchinnikov OS (Ovchinnikov, O. S.)², Jesse S (Jesse, S.)¹, Bintacchit P (Bintacchit, P.)^{3,4}, Trolier-McKinstry S (Trolier-McKinstry, S.)^{3,4}, Kalinin SV (Kalinin, S. V.)¹

Addresses:

1. Oak Ridge Natl Lab, Oak Ridge, TN 37831 USA
2. Univ Tennessee, Dept Phys & Astron, Knoxville, TN 37996 USA
3. Penn State Univ, Dept Mat Sci & Engn, University Pk, PA 16802 USA
4. Penn State Univ, Mat Res Inst, University Pk, PA 16802 USA

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Abstract: An approach for the direct identification of disorder type and strength in physical systems based on recognition analysis of hysteresis loop shape is developed. A large number of theoretical examples uniformly distributed in the parameter space of the system is generated and is decorrelated using principal component analysis (PCA). The PCA components are used to train a feed-forward neural network using the model parameters as targets. The trained network is used to analyze hysteresis loops for the investigated system. The approach is demonstrated using a 2D random-bond-random-field Ising model, and polarization switching in polycrystalline ferroelectric capacitors.