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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 17 January 2023, 9:00 s.t., TU Darmstadt, via Zoom



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Behind the twin supermobility in ferromagnetic shape memory alloys: microstructures, modulations and vibrational response

Abstract:

Ni-Mn-Ga-based single crystal exhibit a stunning variety of magneto-mechanical functionalities, most of them being based on the extreme mobility of twin boundaries. The physical background of this phenomenon is still not fully understood, despite the extensive research in this direction carried out worldwide. The lecture will summarize the current knowledge regarding supermobile twin boundaries in Ni-Mn-Ga, focused mainly on comparing the experimental observations and the theoretical predictions. Surprisingly, the most vital clue towards explaining the supermobility does not come from the points where the theory and the experiment meet, but from the point where they give completely different results. It turns out that the Ni-Mn-Ga lattice has an internal degree of freedom, not captured by the first-principles calculations, that might enable the twins to move with extremely low energy dissipation. This additional degree of freedom has some intriguing impacts on the behavior of Ni-Mn-Ga single crystals, turning them, for example, into strongly nonlinear low-amplitude/high-frequency mechanical oscillators, which is an effect rarely seen anywhere else in the mechanics of materials.

Joint work with O. Heczko, L. Straka, P. Sedlák, K. Zoubková, T. Grabec (Prague), M. Zelený (Brno) and A. Sozinov (Lappeenranta).

About the speaker:

Hanuš Seiner is a research professor and department head at the Institute of Thermomechanics, Czech Academy of Sciences, Prague. His research interests cover mainly martensitic microstructures, shape memory alloys, and the characterization of phase-transforming materials by laser-ultrasonic experimental methods. In 2016, he was awarded the Otto Wichterle Award for outstanding young researchers by the Czech Academy of Sciences, and one year later he received the Fulbright Fellowship for staying (2017-2018) as a Visiting Fulbright Scholar at the University of Minnesota, US.