HEMI Seminar

On Modeling Strength Differential Effects of Anisotropic HCP Metals

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December 6 | 11:00 AM | Malone G33 / 35

Large deformation plasticity of HCP metals has been increasingly studied for potential automotive and other advanced applications. To enhance the predicative capabilities of numerical simulations of metallic components and structures in these new engineering applications, constitutive models of metal plasticity used in existing finite element codes must be continuously improved and updated for HCP metals. Unlike FCC and BCC metals, the strong tension-comprehension asymmetry of yielding and plastic flow behaviors in HCP metals can no longer be ignored. This talk first gives a brief overview on the historical development of Hill's mathematical theory of orthotropic plasticity that leads to two currently popular modeling approaches of strength differential effects in metal plasticity, namely, kinematical hardening (KH) and homogenous anisotropic hardening (HAH). The main differences between these two modeling approaches as well as their shortcomings are pointed out. An alternative modeling approach using piecewise non-quadratic polynomial yield functions will then be presented for magnesium alloys under tension and compression loadings. The talk concludes with a discussion on the similarities and differences between the strength differential and Bauschinger effects in metal plasticity.

Dr. Wei Tong is a Professor in the Department of Mechanical Engineering at Southern Methodist University (SMU) since 2005. His research and teaching interests are primarily in experimental and computational mechanics of materials, with current efforts including whole-field strain measurements by digital image correlation, advanced constitutive modeling of metal plasticity and ductile failure, and numerical simulations of various metal forming processes. He had conducted high-speed pressure-shear plate impact experiments on metals under supervision of Rodney J. Clifton at Brown and worked subsequently as post-doctoral researchers at both MIT and Caltech prior to academic appointments.

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