SEMINARIO INTERUNIVERSITARIO DE MECÁNICA Y MATERIALES

SEMINARIO JOSÉ ANTONIO GARCÍA GARCÍA

MÁSTER DE ESTRUCTURAS

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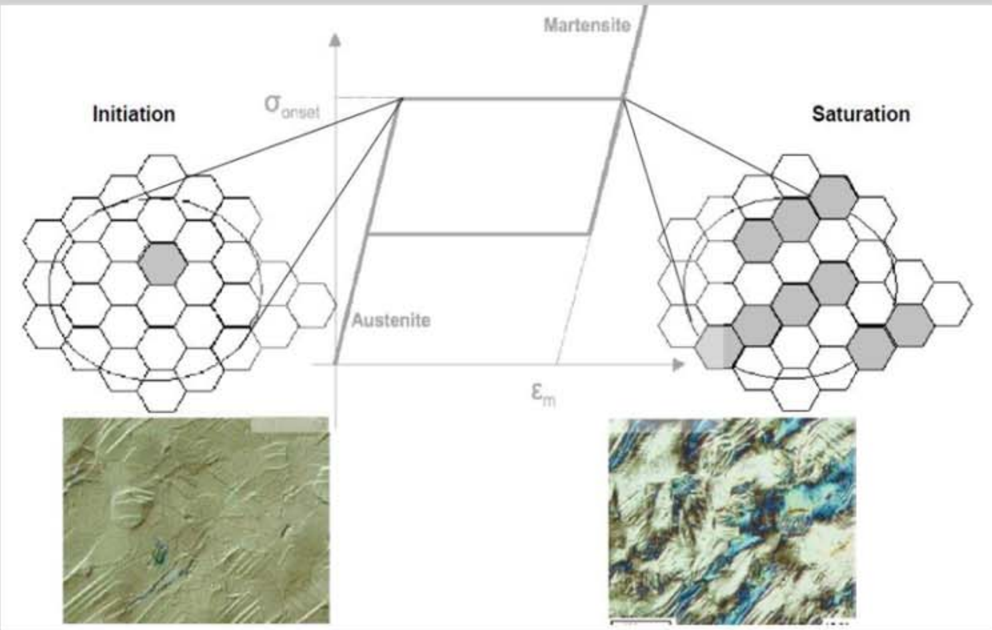
Cyclic deformation and the interplay between phase transformation and plasticity in shape-memory alloys



Prof. Kaushik BHATTACHARYA

Professor of Materials Science
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Pasadena, CA 91125, USA

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Hora : 12:30h
Lugar : seminario I, 4ª planta, E.T.S. Ing. Caminos, C. y P.
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Cyclic deformation and the interplay between phase transformation and plasticity in shape-memory alloys

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This work seeks to understand the the cyclic behavior of shape-memory alloys. The shape-memory effect as well as super-elastic properties evolve with cycling as a result of interplay between phase transformation and plasticity. The interplay between these two modes of deformation becomes especially intricate in polycrystalline materials due to crystalline anisotropy and inter-granular constraints. For example, plastic slip enables the progression of transformation that is inhibited by intergranular constraints; it may also retard the reverse transformation due to the creation of microscopic stress. The interplay can also have important technological implications like the loss of memory during cycling in shape-memory alloys and unusual strain-rate effects in steel. Unfortunately, this is a difficult multi-scale problem with the formation of intricate transformation and dislocation structures at the sub-granular level and the complex interactions across multiple grains. Consequently, the interplay between these two mechanisms and their combined effects on the macroscopic response of polycrystalline materials remains poorly understood. This talk will describe a computational study of this interplay. We start with a coarse-grained model at the single crystal that implicitly accounts for the transformation and dislocation microstructures. This makes the model quite efficient and allows us to study polycrystalline specimens. The results provide interesting insights into the phenomenon, and provides hint for the development of a detailed macroscopic model.

Biography:
Kaushik Bhattacharya is Howell N. Tyson, Sr., Professor of Mechanics and Professor of Materials Science as well as the Executive Officer for Mechanical and Civil Engineering at the California Institute of Technology. His research concerns the mechanical behavior of solids, and specifically uses theory to guide the development of new materials. He received his B.Tech degree from the Indian Institute of Technology, Madras, India in 1986, his Ph.D from the University of Minnesota in 1991 and his post-doctoral training at the Courant Institute for Mathematical Sciences during 1991-1993. He joined Caltech in 1993. He has held visiting positions at Cornell University, Heriot-Watt University (Scotland), Max-Planck-Institute (Leipzig, Germany), University of Cambridge (England), Indian Institute of Science (Bangalore, India) and the Jet Propulsion Laboratory. He is currently an Editor of the Journal of the Mechanics and Physics of Solids, and serves on the Editorial Board of other notable archival journals.