DEPARTMENT of INDUSTRIAL ENGINEERING
UNIVERSITY of HOUSTON

FRIDAY SEMINAR SERIES
BROADEN HORIZONS | EXTEND MINDS

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Date: Friday, Feb 8, 2019

Time: 1 - 1:50 pm

Location: D3 W122

Multiscale Modeling of Third Generation Advanced High Strength Steels

Abstract: In this talk I will introduce a new crystal plasticity finite element model (CPFEM) for third generation (GEN 3) Advanced High Strength Steels (AHSS), to account for the complex microstructure of multiphase steel, and austenite to martensite phase transformation caused by large plastic deformation during room temperature stamping. To statistically represent the microstructure of QP980 and QP1500 steels, 3D representative volume elements (RVEs) were generated with Dream3D software. The CPFEM material parameters for each phase were calibrated with the uniaxial tension test stress-strain data obtained for each phase from experiment. The calibrated CPFEM model for QP980 and QP1500 steels were then used to predict the macroscopic stress-strain curves under different loadings, including balanced biaxial tension and cyclic loading. We use the CPFEM model to perform virtual experiments to generate necessary data for the calibration of advanced anisotropic yield functions for GEN 3 AHSS sheet, as well as to predict its formability. Finally, additional fictitious RVEs were generated with different combinations of phase volume fractions, and grain size distributions, to study the effect of microstructure on the macroscopic mechanical performance of AHSS steels.

Biography: Prof. Farhang Pourboghrat is a Professor and chair of the ISE Department at OSU. He received his BSME and MSME degrees from U. Iowa, and his PhD degree in Mechanical Engineering (ME) from U. Minnesota in 1990. From 1990 to 1998, he worked as a staff scientist at the Alcoa Technical Center. From 1998-2015, he served as a faculty in the ME Department at Michigan State University. His research interests are in the multiscale characterization of engineered materials and modeling of advanced forming processes, including warm forming of sheet metals, tube hydroforming and incremental sheet forming. His research has a strong emphasis on the computational modeling of forming processes using microstructure-based material models such as crystal plasticity and advanced phenomenological yield functions. He is a member of the American Society of Mechanical Engineers (ASME), and the Sigma Xi technical honor society. He has served as a member of the steering and scientific committee for the Numerical Simulation of 3D Sheet Forming Processes (NUMISHEET) since 2005, and co-organized the 2005 Numisheet Conference in Detroit, MI.