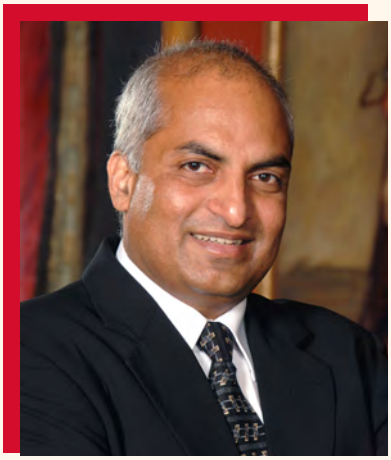
Sep 05, 2019

Materials Innovation Driven by Data and Knowledge Systems



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ABSTRACT:

Emerging concepts and toolsets in Data science and Cyberinfrastructure can be strong enablers for systematic mining and automated capture of Materials Knowledge and its dissemination to distributed cross-disciplinary teams engaged in materials innovation efforts. A data-driven framework is also foundational to the development and implementation of autonomous explorations of the unimaginably large materials and process design spaces while synergistically leveraging all available experimental and simulation data. Although tremendous progress has been made in the development and validation of a wide range of simulation toolsets capturing the multiscale phenomena controlling the material properties and performance characteristics of interest to advanced technologies, their systematic insertion into the materials innovation efforts has encountered several hurdles. The ongoing efforts in my research group are aimed at accelerating materials innovation through the development of (i) a new mathematical framework that allows a systematic and consistent parametrization of the extremely large spaces in the representations of the material hierarchical structure (spanning multiple length/structure scales) and governing physics across a broad range of materials classes and phenomena, (ii) a new formalism that evaluates all available next steps in a given materials innovation effort (i.e., various multiscale experiments and simulations) and rank-orders them based on their likelihood to produce the desired knowledge (expressed as PSP linkages), and (iii) novel higher-throughput experimental assays that are specifically designed to produce the critically needed fundamental materials data for calibrating the numerous parameters typically present in multiscale materials models. I will present and discuss ongoing research activities in my group.

BIOGRAPHY:

Surya Kalidindi is a Professor in the Woodruff School of Mechanical Engineering at Georgia Institute of Technology, Georgia, USA with joint appointments in the School of Materials Science and Engineering as well as the School of Computational Science and Engineering. Surya earned a Ph.D. in Mechanical Engineering from Massachusetts Institute of Technology in 1992, and joined the Department of Materials Science and Engineering at Drexel University as an Assistant Professor. After twenty years at Drexel University, Surya moved into his current position at Georgia Tech. Surya's research efforts have made seminal contributions to the fields of crystal plasticity, microstructure design, and materials informatics. Surya has been elected a Fellow of ASM International, TMS, and ASME. In 2016, he and his group members have been awarded the top prize as well as one of the runner-up prizes in the national Materials Science and Engineering Data Challenge sponsored by the Air Force Research Lab in partnership with the National Institute of Standards and Technology and the U.S. National Science Foundation. He has also been awarded the Alexander von Humboldt Research Award, the Vannever Bush Faculty Fellow, the Government of India's Vajra Faculty Award, and the Khan International Award.