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SPEAKER TITLES/ABSTRACTS

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"Materials Innovation Driven by Data and Knowledge Systems"

Current approaches to exploring materials and manufacturing (or processing) design spaces in pursuit of new/improved engineered structural materials continue to rely heavily on extensive experimentation, which typically demand inordinate investments in both time and effort. 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 most common of these are related to (i) the lack of a generalized (applicable to a wide variety of materials classes and phenomena) mathematical framework that allows objective extraction and synergistic integration of the high value materials knowledge (defined from the perspective of producing reliable process-structure-property (PSP) linkages) from all available datasets (including a variety of multiscale experiments and simulations), while accounting for the inherent uncertainty associated with each dataset, (ii) the lack of formal approaches that identify objectively where to invest the next effort (could be a new experiment or a new simulation) for maximizing the likelihood of success (i.e., meeting or exceeding the designer-specified combinations of materials properties) at any step of the innovation effort, and (iii) the lack of experimental techniques that are specifically designed to provide the quality and quantity of information needed to calibrate the large number of material parameters present in most multiscale materials models. This talk will describe ongoing efforts in my research group aimed at addressing the gaps identified above.