Biography

Chandra Prakash is presently a postdoc working with **Prof. Somnath Ghosh** in the Civil and Systems Engineering Department at **Johns Hopkins University.** His postdoctoral research involves the development of experimentally validated multiscale modeling and design platform composite materials for aerospace structures. Prior to that, he completed his Ph.D. in Aeronautics and Astronautics from **Purdue University** under the supervision of **Prof. Vikas Tomar** and **Prof. Ibrahim Gunduz** in December 2018. For his Ph.D. dissertation, he worked on developing a combined experimental and computational study to investigate the effect of interface chemical composition on the high-strain-rate dependent mechanical behavior of an energetic composite. During his Ph.D., he developed a novel experimental technique for real-time in-situ measurement of dynamic thermo-mechanical properties of composite and metal alloys at nano- and microscale. Before joining Purdue, he earned his master's degree in Mechanical Engineering from **IIT Kanpur** in 2014 and his bachelor's degree in the same discipline from the **NIT Raipur** in 2011. Chandra's research interests lie in developing an integrated multiscale computational-experimental framework for process-structure-property-performance relation of additively manufactured materials for applications under extreme conditions.

Abstract:

Composite materials are widely used in a variety of military, aerospace, automotive, naval applications, among others. In many of these applications, the structures are subjected to impulsive loadings, e.g., debris impact during plane takeoff or landing or explosive fragmentation. Understanding the microstructural connection to the overall behavior of composite materials under high-strain-rate impact loading is of critical importance for the design and development of such materials. However, the computational cost and unavailability of experimental data under these highly transient conditions limit further development. At the same time, experimental studies of materials under extreme environments are exceptionally challenging due to their rapid evolution at a broad range of time and length scales. This talk aims to provide: 1) a general computational framework to develop effective constitutive models for hierarchically upscaling information from the lower to higher scales, and 2) a real-time, in-situ experimental characterization technique to develop nano/micro-scale thermo-mechanical models. The proposed computational framework is developed using a novel self-consistent concurrent model accounting for microscale inertia due to stress wave superposition and annihilation within the microstructure at high strain rates loading. The effective constitutive model directly connects the evolution of macroscopic damage and microstructural morphology, inertia, deformation, and failure mechanisms. A combined mechanical Raman spectroscopy and pulse laser-based particle impact set up coupled with a photon doppler velocimetry is proposed to measure the grain/interface level stress and temperature distribution. The developed experimental set-up has been used to measure the failure strength, thermal conductivity, and shock viscosity at material interfaces under high-strain-rate and high-temperature conditions. The combined experimental and computational framework develops a better understanding of the complex microstructural effects on the macro-scale behavior and design of composite materials and metal alloys.