Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Gupta is a trained mechanical engineer. He has expertise in solid mechanics and materials science, with a specialization in analytical and computational modeling to understand the mechanical response of materials across various length and time scales. He has applied his expertise in a myriad of applications, ranging from munitions design to the additive manufacturing of metals.

Dr. Gupta is proficient in employing computational methods, such as Molecular Dynamics (MD), Discrete Element Modeling (DEM), and the Finite Element Method (FEM) to predict material behavior and response. Additionally, he integrates experimental characterization techniques, including Electron Backscatter Diffraction (EBSD), Scanning Electron Microscopy (SEM), high-speed X-Ray Phase Contrast Imaging (XPCI), and X-Ray Computer Tomography (XRCT), with computational models to make informed predictions of material response.

Dr. Gupta pursued his Ph.D. in Mechanical Engineering at Johns Hopkins University (JHU), where he was a member of the Hopkins Extreme Materials Institute (HEMI). His doctoral research focused on developing experimental and micromechanical modeling techniques for granular media (e.g. soils and sands) to link particle packing and morphology to continuum response under different loading conditions. Dr. Gupta also taught classes at JHU in continuum mechanics and micromechanics.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Johns Hopkins University, 2024

M.S., Mechanical Engineering, Johns Hopkins University, 2020

B.S., Materials Science and Engineering, University of California, Berkeley, 2018

Best Poster Award at the Mach Conference (2023)

Hap Arnold Scholar (2022)

Graduate Student Poster Award at the Society for Engineering Sciences (2021)

JHU Departmental Fellowship (2018)

Blue Ribbon Poster Award at the Lawrence Livermore National Laboratory Summer Student Poster Symposium (2017)

Prior Experience

Graduate Researcher, Johns Hopkins, 2018-2024

Researcher, Air Force Research Laboratory, 2022

Materials Engineer, Chevron, 2018

Researcher, Lawrence Livermore National Laboratory, 2017

Researcher, US Navy (NAVAIR), 2016

Researcher, SRI International, 2014

Languages

French (France)

Hindi

Publications

Gupta, A., Ramesh, K. T., & Hurley, R. C. (2024). Instabilities in a two-dimensional granular fault gouge: Particle dynamics and stress fluctuations. Journal of the Mechanics and Physics of Solids , 105843.

A. Gupta, K.T. Ramesh, R.C. Hurley (2024). An inclusion model for predicting granular elasticity incorporating force chain mechanics. Granular Matter, 26(2), 40.

A. Gupta, R.S. Crum, C. Zhai, K.T. Ramesh, R.C. Hurley (2021). Quantifying particle-scale 3D granular dynamics during rapid compaction from time-resolved in situ 2D X-ray images. Journal of Applied Physics, 129(22), 225902.

Presentations

A. Gupta, K.T. Ramesh, R.C. Hurley (October 2023). A Force-Chain Based Plasticity Model for Prediction of Stress Drops in Granular Media. Society of Engineering Science (SES) Annual Conference, 2023, Minneapolis, MN.

A. Gupta, K.T. Ramesh, R.C. Hurley (October 2022). Linking microscopic force-chains to macroscale mechanical response in granular media. Society of Engineering Science (SES) Annual Conference, 2022, College Station, TX.

A. Gupta, K.T. Ramesh, R.C. Hurley (April 2022). The effect of force-chain buckling and fabric on bulk stiffness and stress response in granular media. 2022 Mach Conference, Virtual.

A. Gupta, R.C. Crum, C. Zhai, K.T., Ramesh, R.C. Hurley (March 2021). Inferring 3D Particle Kinematics from 2D X-ray Images. APS March Meeting, 2021, Virtual

A. Gupta, K.T. Ramesh, R.C. Hurley (January 2020). Quantifying Kinematics During High Strain-Rate Loading of Granular Materials. 44th International Conference and Expo on Advanced Ceramics and Composites (ICACC 2020), Daytona Beach, FL.

A. Gupta, K.T. Ramesh, R.C. Hurley (October 2019). Quantifying Kinematics During High Strain-Rate Loading of Granular Materials. Society of Engineering Science (SES) Annual Meeting, St. Louis, MO.

A. Gupta, R.O. Ritchie, (October 2017). An Artificial-Intelligence Driven Post-Test Failure Analysis Technique. Materials Science and Technology (MS&T) Annual Meeting. Pittsburgh, PA.

Project Experience

- Investigated effects of hotspot geometry and temperature on criticality in single-crystal HMX. Performed thermal modeling using finite element analysis (FEA) and determined conditions most favorable for cook-offs, thermal explosions, and detonation.

- Performed a materials selection process to upgrade metallurgy for Crude Units at a refinery to address challenges posed by corrosion damage mechanisms. Developed a Heat Exchanger Inspection Model in an effort to reduce turnaround time.

- Evaluated the use of kinetic metallization for repairing F/A-18 aircraft parts. Developed a code that generated meshes from images of microstructure and used finite element analysis (FEA) to model dynamic crack propagation.