2025 IE Summer Internship Project

Project title	A complex stochastic systems framework for space operations engineering
Project description	This summer project concerns the development and numerical implementation of stochastic models of the spatio-temporal evolution of Low earth orbit (LEO). LEO, defined as altitudes between 100KM and 2000KM above the surface of the planet, has entered an era of unprecedented growth of the number of man-made objects driven by commercial operators such as SpaceX's Starlink constellation and/or Amazon's Kuiper constellation. This surge in LEO objects poses unprecedented challenges for space operators to minimize the chance of collisions, and avoid potentially catastrophic debris generating events. The student working on this project will be expected to carry out extensive simulation of complex interacting particle systems and compartmentalized stochastic models. This includes novel density-dependent Markov processes and compartmentalized models with particle diffusion through space. The overall goal of the project will be to gain a reasonable understanding of percolation thresholds (ex., a minimum density threshold) above which runaway cascading effects (resulting in uncontrolled collisions) are apparent in LEO, using numerical and simulation-based methodologies.
Host professor name	Harsha Honnappa Souvik Dhara
Professor/lab websites	https://engineering.purdue.edu/IE/Research/Frontiers/PODAS https://engineering.purdue.edu/SSL https://www.souvikdhara.com
Contact information to whom applicants can direct questions	Harsha Honnappa, honnappa@purdue.edu Souvik Dhara, sdhara@purdue.edu
Other comments	

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