2018 Research Interest/Project Ideas

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Simulation and visualization of particulate swarms in fluids

Particles injected in high concentration in a fluid at rest exhibit a remarkable behavior. They naturally self-organize as swarms and form patterns that resemble those seen in complex turbulent flows (e.g., flow recirculation). The goal of this project is to simulate the physics of this phenomenon using a simulation that couples particles (simulated via discrete element method (DEM)) and fluid flow (CFD). This numerical simulation and the range of results that it will enable will allow for the first detailed visualization of the corresponding patterns and offer new insight into the physical mechanisms that underlie their formation.

A potential application of this work concerns the prediction and steering of small sensors' distribution in underground porous media. (collaboration with Prof. Pyrak-Nolte (Purdue Physics))

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Other potential projects:

* **Project Idea #3:** *Pattern detection and analysis in granular materials*

* **Project Idea #4:** *High-quality reconstruction of very large scale unstructured datasets*

* **Project Idea #5:** *Scalable visualization of dynamic networks*