Siming Liang - Ensemble Score Filter for Tracking Turbulent Atmosphere Dynamics

I will introduce a highly stable and reliable ensemble score filter (EnSF) for solving data assimilation (DA) problems. As a diffusion model-based generative AI approach for DA, the score filter can effectively store the information of filtering density in the score model, and the EnSF adopts an ensemble approximation scheme to efficiently approximate the filtering density scores. To showcase its advantageous performance, we compared EnSF with the Local Ensemble Transform Kalman Filter (LETKF) in DA for a surface quasi-geostrophic (SQG) model, and we have demonstrated the superior performance of EnSF over LETKF in scenarios involving incomplete knowledge of the state dynamical model and nonlinear/partial observations.

Priyanka Joseph - A simplified model for erosion and deposition in elastic porous media

In this study, we investigate the dynamic processes of erosion and deposition in a porous medium that occur when the solid internal morphology of the porous medium interacts with fluids at its contact interface. These phenomena are encountered in both natural settings, such as soil erosion, and various industrial applications, like water filtration devices and membrane filters [1]. The focus of our research is to develop a comprehensive continuum model that accurately describes how erosion and deposition influence the internal morphology of a porous medium under a feed flow. To achieve this, we utilize first principle governing equations, including the Darcy and continuity equations, to model the fluid flow.

We also incorporate the advection-diffusion equation to study the mass transport of particles within the medium. By integrating an erosion and deposition evolution model, we can effectively monitor changes in both the porous medium porosity and the particle concentration. In order to simplify our model, we employ techniques such as nondimensionalization and asymptotic analysis to reduce the number of parameters and facilitate finding solutions. As a result of the erosion and deposition model, the porous medium expands and shrinks due to erosion and deposition, respectively.

Amy Sims: A simplified mathematical model for cell proliferation in a tissue-engineering scaffold
This work presents a comprehensive continuum model for cell proliferation within two-dimensional tissue-engineering scaffolds. The study reduces computational burdens and solves mathematical models for tissue growth within porous scaffolds. The model incorporates fluid dynamics of nutrient feed flow, nutrient transport, cell concentration, and tissue growth, considering the evolving scaffold porosity due to cell proliferation. The crux of the work establishes the ideal pore shape for channels within the scaffold to obtain maximum tissue growth. We investigate scaffolds with specific two-dimensional initial porosity profiles; our results show scaffolds which are uniformly graded in porosity throughout their depth promote more tissue growth.