NYIT College of Arts & Sciences
Department of Mathematics

Pejman Sanaei
Assistant Professor
Department of Mathematics, New York Institute of Technology
Room 715, 16 West 61st street, New York, NY 10023-7692
Phone: (212) 261-1672, e-mail: psanaei@nyit.edu

The Graduate Student Mathematical Modeling Camp (GSMMC)
University of Delaware
June 9-12, 2021

Mathematical Models and Simulations of Reconfigurable Flow Networks: Erosion, Deposition, Filtration and Growth

Abstract: Erosion, deposition, filtration and cell growth (EDFG) may seem unrelated at first, but they all stem from a set of similar first principles. These concepts show up in several different industrial applications such as: (i) petroleum geology for discovering natural gases or other natural resources trapped within the rocks; (ii) membrane filters, which are used in various critical aspects of human life such as water purification, the biotechnology industry, and kidney dialysis; and (iii) tissue engineering, which is vital in creating functional tissue and organ samples external to the body to replace damaged or diseased tissues and organs needed in multiple clinical therapies. In dynamic flow networks, reconfiguration and changes of topology that may arise due to EDFG, are very complicated processes, which are also expensive and challenging to study in most real-world applications. This workshop takes an integrated approach, to formulate (i) Stokes; (ii) advection-diffusion; and (iii) Navier-Caushy equations for the flow, particle concentration and elasticity of complex structures, respectively. It is notable that the experimental literature far outweighs the theoretical and numerical literature; and among them there is a paucity of studies that offer first-principles, predictive mathematical models and simulations. The discoveries of this field have potential for significant impact in bridging this gap.