Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A comparison between functional derivative-based global sensitivity analysis and mixed Karhunen-Loève active subspace analysis of flows through porous media with uncertain material properties MEILIN YU, University of Maryland, Baltimore County, ALEN ALEXANDERIAN, HELEN CLEAVES, HAYLEY GUY, RALPH SMITH, North Carolina State University — Flows through porous media, such as aquifer and biological tissues, are usually affected by the uncertain material properties. Quantifying the flow uncertainty due to the material uncertainty, and identifying the flow sensitivity to material properties are important practices to understand the underlying flow physics. Recently we have developed a functional derivative-based global sensitivity analysis (GSA) method and a mixed Karhunen-Loève active subspace analysis method for surrogate modeling of models with high-dimensional inputs and functional outputs. We have applied these two approaches to analyze the pressure field from biotransport in porous tumors. We find that the functional derivative-based GSA method is effective in finding input parameters in the parameterization of material properties that the pressure field is sensitive to; and the mixed Karhunen-Loève active subspace analysis method can identify a linear combination of input parameters that contribute most to the formation of coherent structures in the flow field. The connection between the two methods is studied in the context of biotransport in porous biological tissues.

Meilin Yu
University of Maryland, Baltimore County

Date submitted: 02 Aug 2019 Electronic form version 1.4