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Uncertainty Quantification of Nonlinear Electrokinetic Response in a Microchannel-Membrane Junction SHIMA ALIZADEH[1], GIANLUCA IACCARINO, ALI MANI, Stanford University — We have conducted uncertainty quantification (UQ) for electrokinetic transport of ionic species through a hybrid microfluidic system using different probabilistic techniques. The system of interest is an H-configuration consisting of two parallel microchannels that are connected via a nafion junction. This system is commonly used for ion preconcentration and stacking by utilizing a nonlinear response at the channel-nafion junction that leads to deionization shocks. In this work, the nafion medium is modeled as many parallel nano-pores where, the nano-pore diameter, nafion porosity, and surface charge density are independent random variables. We evaluated the resulting uncertainty on the ion concentration fields as well as the deionization shock location. The UQ methods predicted consistent statistics for the outputs and the results revealed that the shock location is weakly sensitive to the nano-pore surface charge and primarily driven by nano-pore diameters. The present study can inform the design of electrokinetic networks with increased robustness to natural manufacturing variability. Applications include water desalination and lab-on-a-chip systems.

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