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Fast Simulation of Membrane Filtration by Combining Particle Retention Mechanisms and Network Models[1] ARMIN KRUPP, IAN GRIFFITHS, COLIN PLEASE, University of Oxford — Porous membranes are used for their particle retention capabilities in a wide range of industrial filtration processes. The underlying mechanisms for particle retention are complex and often change during the filtration process, making it hard to predict the change in permeability of the membrane during the process. Recently, stochastic network models have been shown to predict the change in permeability based on retention mechanisms, but remain computationally intensive. We show that the averaged behaviour of such a stochastic network model can efficiently be computed using a simple partial differential equation. Moreover, we also show that the geometric structure of the underlying membrane and particle-size distribution can be represented in our model, making it suitable for modelling particle retention in interconnected membranes as well. We conclude by demonstrating the particular application to microfluidic filtration, where the model can be used to efficiently compute a probability density for flux measurements based on the geometry of the pores and particles.

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