Network Models for Membrane Filtration

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This project focuses on industrially-relevant fundamental research to model, simulate and optimize the pore structure, flow and fouling characteristics of porous membrane filters. Thanks to recent advances in the development of fast computational tools, numerical solution of the full Navier-Stokes equations and tracking of individual particles in the feed has become a feasible approach for modeling membrane filtration. Such models are however complex and their implementation is highly non-trivial and time consuming. The present project follows a different route that simplifies the fluid flow and particle deposition significantly, and focuses on combining graph-theoretic tools with asymptotic methods and fluid dynamics to formulate detailed yet tractable models of membrane pore networks that can incorporate pore connectivity and heterogeneity, while accounting for transport of different particle species and multiple fouling mechanisms. The project goals are too elucidate and explain key relationships between properties of the pore network, and the performance of the associated filter. The project will build upon existing work that has formulated the basic building blocks of the network model that will be developed. We anticipate close interaction with the colleagues from industry.

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