

Mechanical Engineering Thesis Defense

Numerical Modeling of Cake Formation and Permeate Flux Decline in Membrane Filtration Using OpenFOAM

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abstract

Membrane filtration is an important technology in industry. In the past few decades, equations have been developed from experimental results to predict cake formation and permeate flux decline in the membrane filtration process. In the current work, the block of particles on membrane surface is achieved by setting surface flux on membrane surface zero. This approach is implemented for both microfiltration and nanofiltration using OpenFOAM. Moreover, a new method to deal with cake resistance for nanofiltration is introduced. Cake resistance is applied to both cake and membrane. To validate the new techniques, results of crossflow microfiltration are compared to theoretical results and results of two crossflow nanofiltration models are compared to experimental data. In addition, the new techniques are applied to dead end filtration to observe the different structure of the cake and explore the effect of resistance on velocity profile.

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