Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

On optimization of pleat packing density in a pleated membrane filter[1] MIKHAIL SMIRNOV, DAVE PERSAUD, New York Inst of Tech, DANIEL FONG, U.S. Merchant Marine Academy, PEJMAN SANAEI, New York Inst of Tech — Pleated membrane filters are widely used to remove undesired impurities from a fluid. A filter membrane is sandwiched between porous support layers, then pleated and packed into an annular cylindrical cartridge with a central hollow duct for outflow. While this arrangement offers a high ratio of surface filtration area to volume, the filter performance is not as efficient as a flat filter with the same surface area. This stems from several possible hypotheses including additional resistance from the packing density of the pleats, the complex flow within the pleated membrane, and possible damage of the membrane during the pleating process. In this work, we present a model to investigate the effects of axial variations of the 3D filter cartridge. We also introduce a more detailed description of the geometry that accounts for the cylinder's curvature. Using asymptotic methods to simplify the flow throughout the cartridge makes it possible to investigate how the number of pleats or pleat packing density affects the performance of pleated membrane filters, where the ultimate goal of this study will be to find an optimal number of pleats to achieve optimum filtration performance.

[1]M.S., D.P. and P.S. are supported by an Institutional Support of Research and Creativity (ISRC) grant provided by New York Institute of Technology. M.S. and D.P. acknowledge Edward Guiliano Global Fellowship from the New York Institute of Technology.

Mikhail Smirnov
New York Inst of Tech

Date submitted: 24 Jul 2020 Electronic form version 1.4