TUD Dresden University of Technology, Faculty of Environmental Science,
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Aachener Membran Kolloquium

Analysis of Impeller-Induced Shear Stress Distribution on a Membrane Surface in a Circular Test Cell for Porous Membranes

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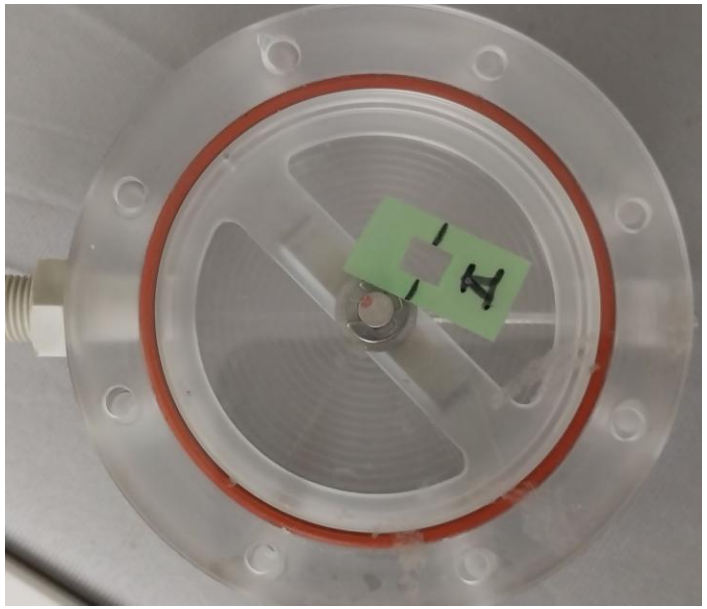
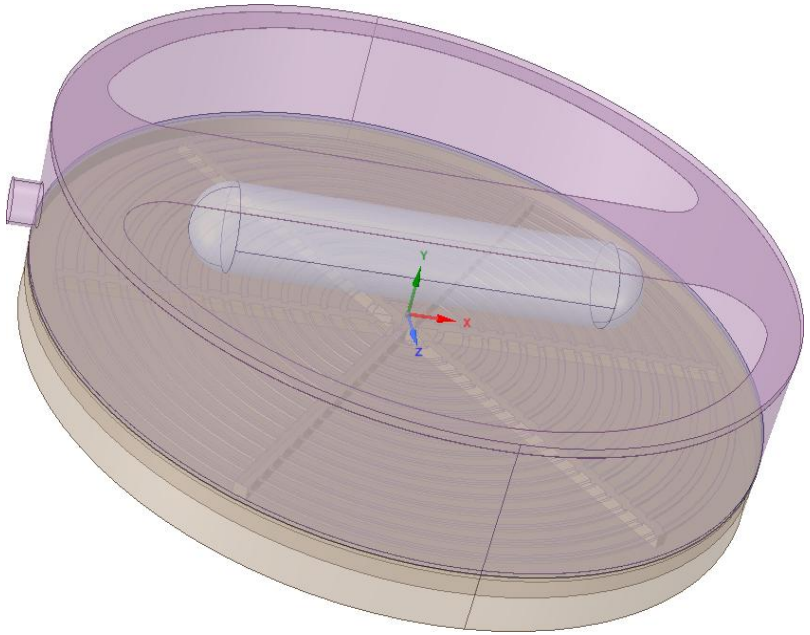
Introduction

Fouling is a common issue in membrane bioreactors, significantly reducing their separation efficiency. Increasing surface shear force is an effective strategy for mitigating or reducing fouling. This study employed a shear-enhanced lab-scale membrane bioreactor, featuring a stationary circular membrane and a rotating impeller with a diameter of 35 mm, housed within a cylindrical cell with a diameter of 56 mm. The computational domain is further refined to closely mimic the real setup.

Laboratory set-up



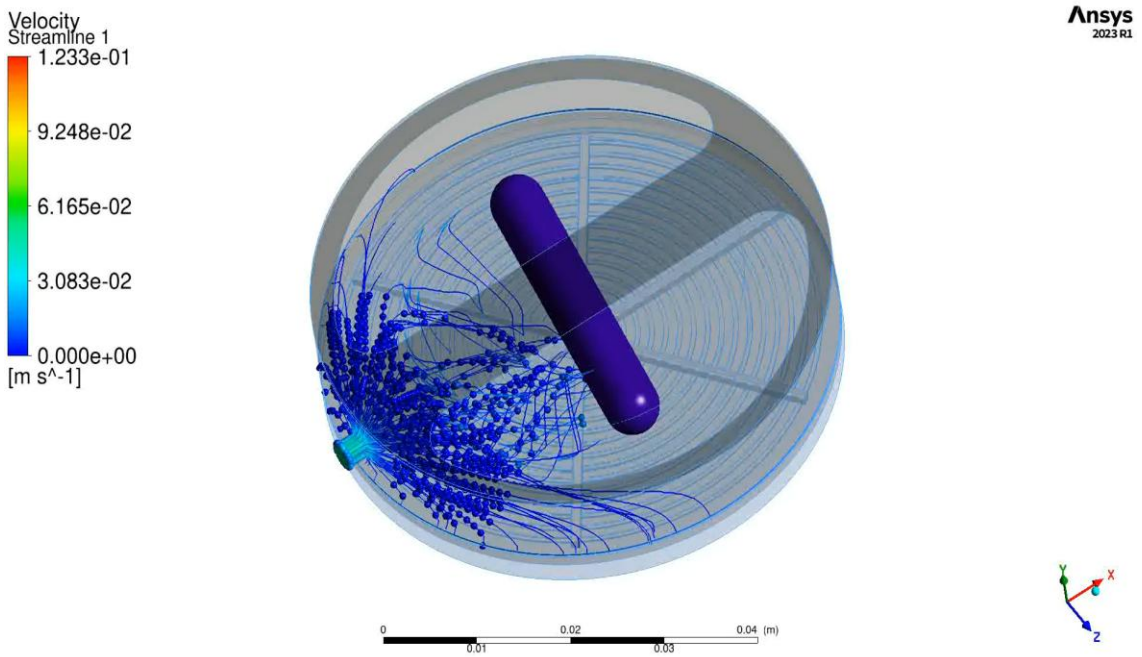
Circular Test Cell



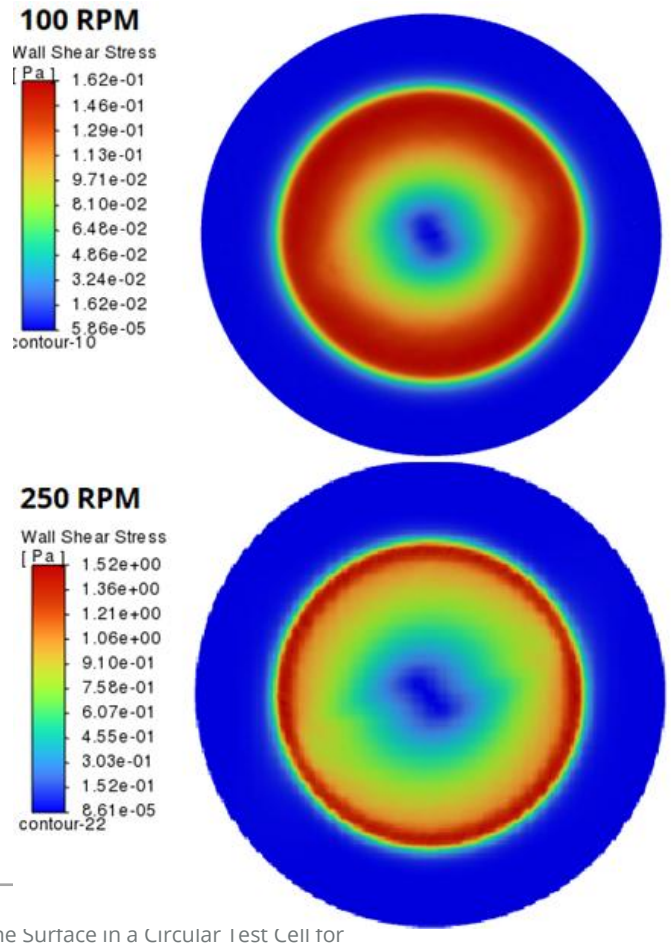
Computational domain for CFD analysis

CFD Analysis

Flow field simulations inside the membrane module were performed using the commercial Computational Fluid Dynamics (CFD) software, ANSYS Fluent.

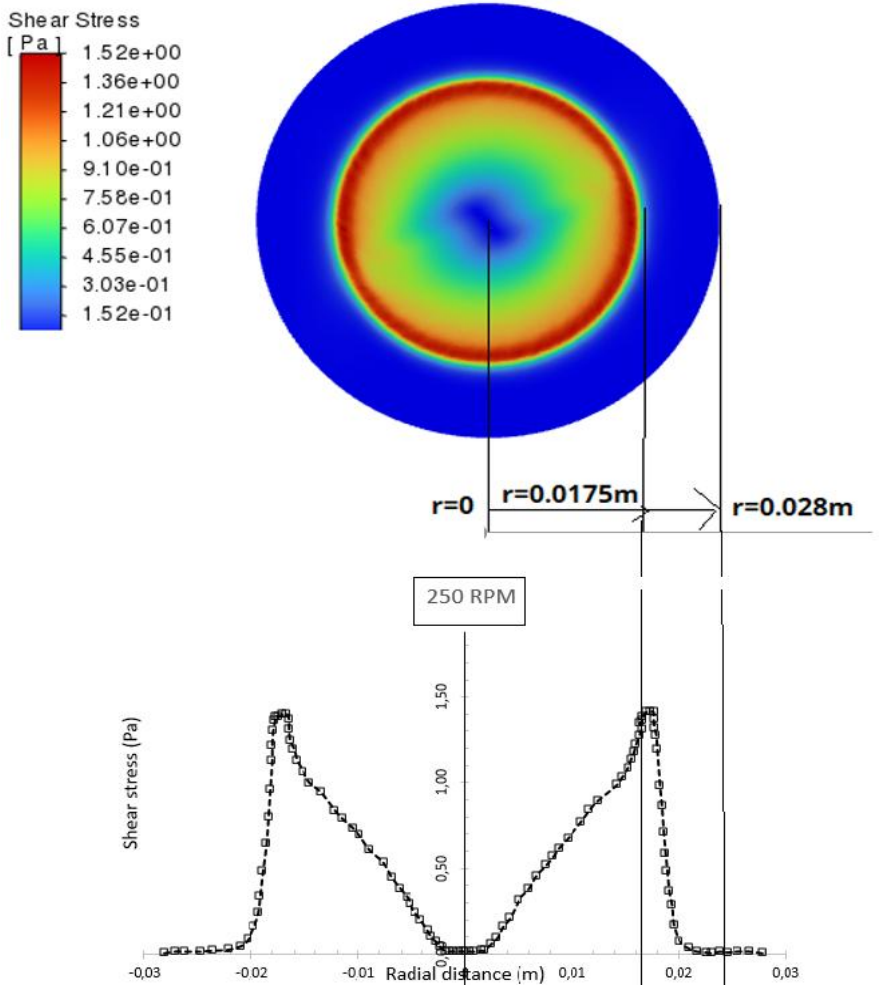


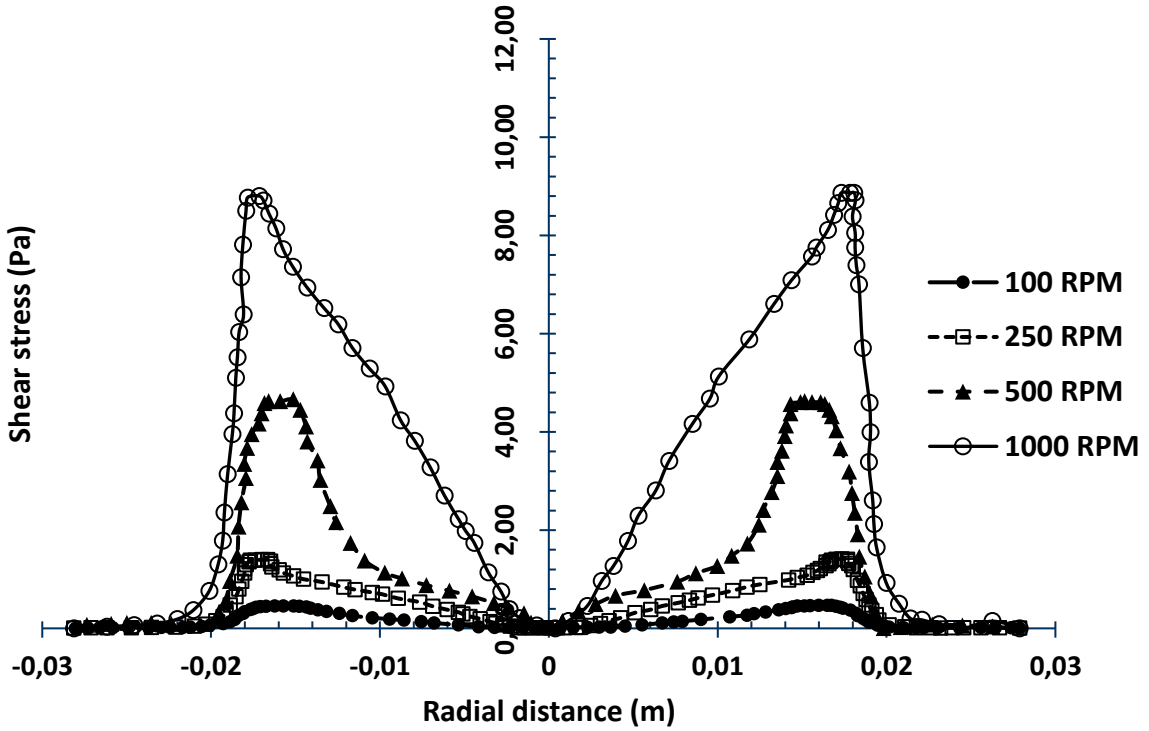
Fluid flow inside the cell



Contours of shear stress

Results of CFD modeling

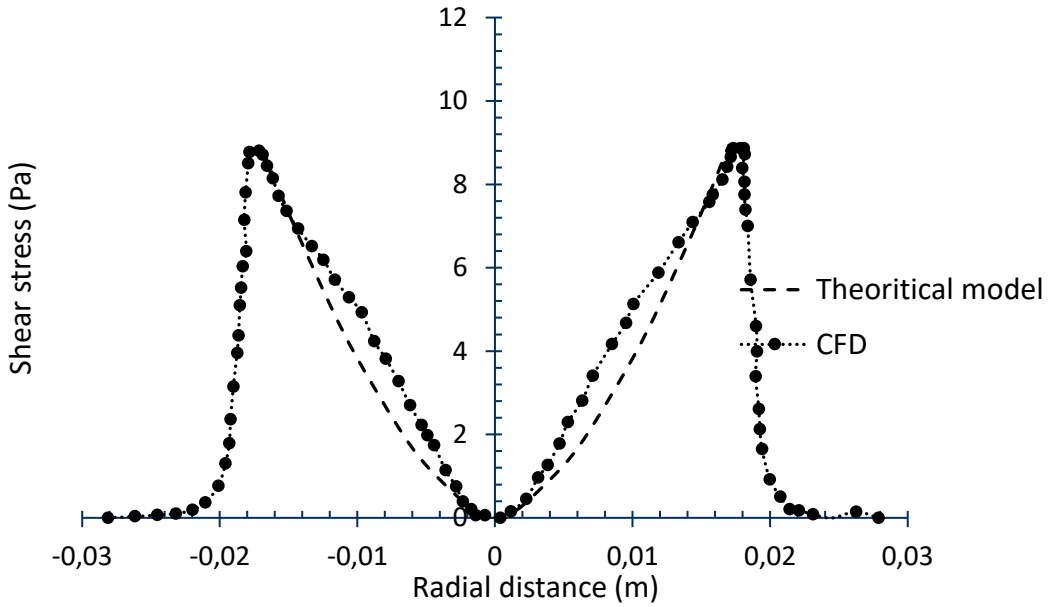




Shear stress distribution on the membrane surface

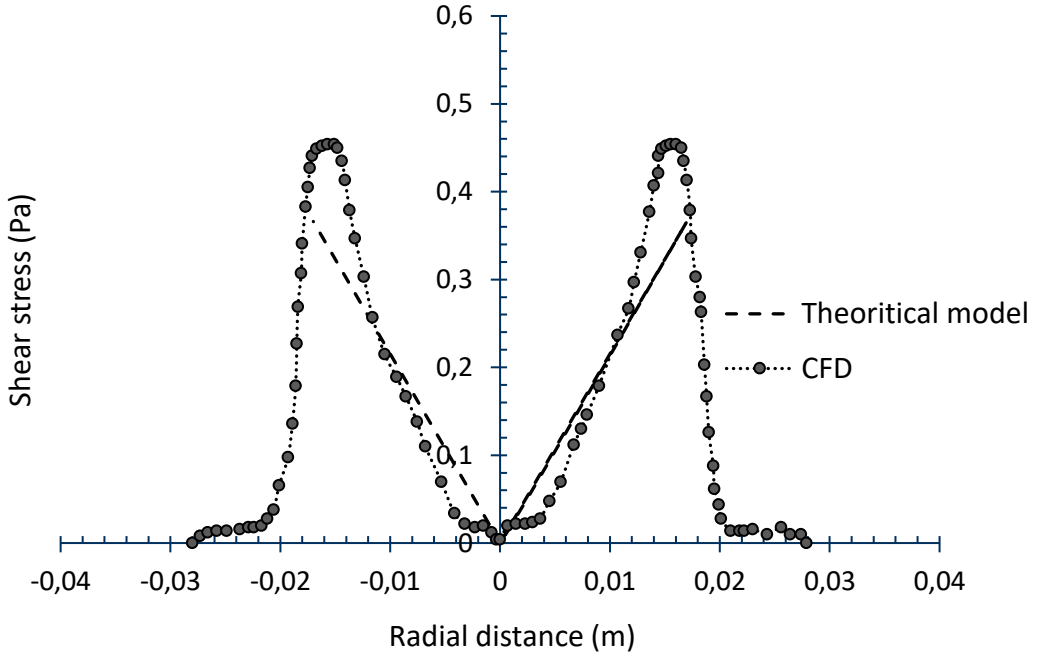
Validation of CFD predictions
Laminar vs. Turbulent flow

Angular Velocity= 1000 RPM



Shear stress distribution under turbulent flow

Angular Velocity= 100 RPM



Shear stress distribution under laminar flow

Thank you for your attention!

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is gratefully acknowledged.