

COLLOQUIUM

Group: Engineering Fluid Dynamics

As part of his MSc thesis assignment

Steven Rozeman

will give a presentation, entitled:

Modeling of Oil/Water Separation and Fouling with Multichannel Ceramic Membranes

Date: Friday June 5, 2015

Time: 10:00

Room: Horst Building Room N-109

Summary:

On many offshore platforms, with the production of oil and gas water is produced as byproduct. This water is called produced water and may contain oil residue, chemicals from production or other contaminants. Environmental regulations require the produced water to be cleaned before it can be discharged in the sea. After treatment with conventional cleaning techniques, the stream of produced water may still contain oil droplets smaller than 20 μ m, unaffected by the conventional cleaning techniques. Separation of these small droplets can be achieved by filtration with ceramic membranes.

Following conventional treatment, the produced water is pressurized and fed through the membrane, which essentially is a tube with porous walls. The pressure difference between the inside and the outside of the membrane provides the driving force for filtration. Water permeates through the walls of the membrane and the oil is retained inside the membrane. For membranes to be interesting for the oil and gas industry, the hydrodynamic effects of upscaling single channel membranes to industrial sized multichannel membranes need to be considered. Also, the decrease in filtration performance from a membrane surface with retained oil droplets (fouling) is of interest. This thesis focusses on the hydrodynamic aspects of upscaling and fouling of ceramic monolith membranes.

Using the finite element package COMSOL Multiphysics, a two dimensional model for existing tubular membranes and industrial sized monolith membranes has been developed. The model uses the resistance-in-series approach in which the flow through the porous layers of the membranes is modeled by Darcy's Law. Additional resistances are implemented to account for the effects of fouling.

The results of the computational model are compared with available test data for clean water and for produced water. The efficiency of an industrial sized multichannel membrane, depends on the properties of the different layers of membrane material. Furthermore, multichannel design and addition of permeate drains is seen to affect membrane efficiency.

Assessment committee:

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Prof.dr.ir. A. Nijmeijer (mentor)
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d.d. _____