Faculty Engineering Technology
Program Mechanical Engineering

University of Twente.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

Peter Müthing

will give a presentation, entitled:

Determination of the gas cap size after well shut-in
Modeling the motion and condensation of bubbles in transient multiphase flows

Date: Friday February 10, 2012

Time: 14:00

Room: ZH 286

Summary:
Subsurface oil reservoirs are connected to surface facilities through wells. If the pressure and temperature conditions allow, gas bubbles are formed in the upper part of the well during flowing conditions, resulting in a multiphase flow. If the flow is stopped by closing a valve at the wellhead (shut-in), phase redistribution occurs: the liquid drains to the bottom while the gas floats to the wellhead. Combined effects of thermodynamics, heat transfer and mass transfer determine the size of the gas cap that will finally be formed at the wellhead. After reopening the wellhead valve, expansion of the gas associated with Joule Thomson cooling leads to low fluid temperatures. Exposing the material of the downstream flowline material to cold fluid for a prolonged time can cause brittle fracture. Hence, accurate knowledge of the gas cap size after shut-in is important.

A fully coupled one-dimensional multiphase flow simulator has been used in the past to determine the gas cap size. However, in this simulator the motion and condensation of bubbles are modeled in a fairly crude way. Yet, these phenomena are expected to be decisive for the size of the gas cap. Therefore, a different approach is chosen in the present research: bubbles are tracked individually by employing Newton's second law, combined with a condensation model based on molecular diffusion. Simulations have been carried out for monodisperse and polydisperse bubble groups. The case of artificial gas lift has been considered as well. A sensitivity study has been carried out on various physical parameters. The results suggest that the size of the gas cap that is formed at the wellhead is in general smaller than predicted by the one-dimensional multiphase flow simulator.

Assessment committee:

Prof.dr.ir. H.W.M. Hoeijmakers (chairman)
Dr ir. R.H.A. IJzermans (Shell, mentor)
Dr. M.A. van Dijk (Shell)
Prof.dr.ir. T.H. van der Meer
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