Faculty Engineering Technology Program
Mechanical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of his MSc thesis assignment

T.A. Láoh

will give a presentation, entitled:

To build and validate a CFD model capturing the physics of a surface tension dominated two-phase flow.

Date: 19-08-2016
Time: 14:00
Room: Horst building, room N109

Summary:
In an ASML lithography machine the use of water for immersion lithography leads to water leakage over the edge of a silicon wafer. Capillary action causes the water to get stuck between the wafer and wafer table. The formation of a capillary between the wafer and wafer table has been associated with a loss of machine performance. Current water removal techniques apply pressure differences to remove the trapped water. However, the current design and settings do not completely remove the water. In the application setting it is not possible to visualize the flow field experimentally. The objective of the present research is to develop a theoretical/CFD model to analyse and predict the behaviour of the water and air flow in the domain and to observe the transient development of wetted and dry spots during the pressure sequence. The flow problem can be characterized as a thin layer/narrow gap two-phase flow problem. Inertia and gravity forces in the flow will be small and surface tension effects may be very strong.

In this work a CFD model has been developed based on the package STAR CCM+. To validate the developed approach some classic problems of surface tension dominated flows with narrow domain aspects have been taken: The Landau-Levich problem of drainage of a vertical plate, and the Bertherton problem of a bubble moving through a narrow tube. The numerical results for these problems show good agreement with results described in literature.

Following this validation, results of the actual flow of water/air between the wafer and wafer table are described. The results give insight into the cause of the insufficient water removal in the domain for the case of the current pressure sequences, and indicates directions for improvement and optimisation of the process.

Assessment committee:

Prof.dr.ir. C.H. Venner	(chairman and mentor)
dr. ir. D.D.J.A. van Sommeren	(mentor)
ir. E. van Vliet	(mentor)
Prof.dr. J.H.Snoeijer	(TNW Physics of Fluids)

Chairman,

d.d. 13/7/2016