

COLLOQUIUM

Group: Engineering Fluid Dynamics

As part of his MSc thesis assignment

H.J. van den Berg

will give a presentation, entitled:

Optimization of a Supersonic Gas Conditioner III

Date: Thursday August 28, 2014

Time: 14:00

Room: Horst Building Room NH.205

Summary:

The present study addresses the design of a supersonic nozzle used to produce dispersed droplet flow. Such devices are applied in industry to separate heavy hydrocarbons and water from natural gas and to generate specific droplet size distributions in extreme ultraviolet light devices.

In classical nozzle design methods the flow parameters are calculated and the geometry is iterated to meet the objectives. In contrast, this study presents the design of a nozzle by prescribing the isentropic constant-expansion rate, employing a sonic throat velocity, which leads to an ordinary differential equation for the nozzle cross-sectional area. This is discussed and investigated theoretically and numerically for the flow of argon.

In the first part of this study the equations for non-condensing flow are rewritten in a non-dimensional form, leading to a single ordinary differential equation for the Mach-number with the ratio of specific heats as the single parameter. This leads to a universal solution only depending on the parameter left.

The second part of the present study addresses condensation of a pure vapor, prescribing sonic and saturated flow in the throat. Condensation is modelled by employing a reduced model called Hills method of Moments. The study presents the results obtained from the model by investigating the dependency of the solution on (i) the expansion rate and (ii) reservoir temperature. Furthermore the sensitivity of the results to the value of the surface tension has been studied.

Assessment committee:

Prof.dr.ir. H.W.M. Hoeijmakers (chairman)
Dr.ir. R. Hagmeijer (mentor)
Dr.ir. P.J. van Dijk
Dr.ir. D.S. van Putten

Chairman,

d.d. _____