



Conform artikel 4.6.8 van het SSNS-wb.



# Colloquium

Vakgroep: Technische Stromingsleer

In het kader van zijn doctoraalopdracht zal

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een voordracht houden getiteld:

## Optimization of a Supersonic Gas Conditioner

Datum: **03-07-2009**

Tijd: **14:00**

Zaal: **N109**

### Summary:

During the rapid expansion of a multi-component gas mixture some of its components may attain a state of super-saturation. In such a state the rate of formation of stable nuclei is extremely high, causing the almost instantaneous formation of tiny droplets, also known as homogenous condensation. This phenomenon is used in gas conditioners to remove undesired components. In such gas conditioners condensation takes place in a Laval nozzle followed by removal of the droplets utilizing swirling flow.

The shape of the nozzle is essential in generating the correct conditions for condensation. The objective of the research is to investigate the possibility to optimize the nozzle geometry in order to maximize the amount of liquid separated. The optimization problem includes a cost-function which aims to maximize liquid removal, subject to constraints on preventing unfavorable events such as thermal choking of the flow. A quasi-one-dimensional approximation of the fluid dynamic equations is used to describe the flow. The process of condensation is described by Hill's Method of Moments, which captures the important physics of condensation at a minimum computational cost.

The parameters used to describe the nozzle geometry are determined such that a minimum is attained in the cost function. Following the application of a global search algorithm, a local gradient method is utilized to find the optimum. Furthermore, the optimization method also allows for the inverse design of a nozzle with as input the axial distribution of the pressure or temperature.

### Examencommissie:

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