Opleiding Werktuigbouwkunde

Universiteit Twente
de ondernemende universiteit

COLLOQUIUM

Conform artikel 4.6.8 van het SSNS-wb.

Vakgroep: **Technische Stromingsleer**

In het kader van zijn doctoraalopdracht zal

E.M. Gerritsen

een voordracht houden getiteld:

Numerical investigation of the gas discharge coefficient for safety valves up to high pressures

Datum: 1-5-2007

Tijd: 11:00

Zaal: OH 115

Summary:
In this project the gas flow capacity of safety valves, a protection system for overpressure, is numerically investigated. The determination of the safety-valve capacity is based on the condition of choked nozzle flow. A factor is used to correct for the difference between the mass flow rate of the nozzle flow and that of the safety valve flow. This discharge coefficient $K_d = \dot{m}_{\exp,SV} / \dot{m}_{ideal,nozzle}$ is experimentally determined at low pressure and separately for gases and liquids. In the current standards the discharge coefficient is assumed to be constant; independent of gas type, valid for pressures up to 700 bar, and not depending on the size of the safety valve (ISO standard 4126-1).
Using computational fluid dynamics, i.e. CFX, in the present study this K_d factor is investigated.
First the accuracy of determining mass flow rates through a simple throttling device was studied. A choked nozzle flow was numerically simulated assuming axi-symmetric flow. The mass flow rate was determined at pressures up to 200 bar, and validated with values from ISO standard 9300. The inaccuracy of the results of the numerical simulations turned out to be less than 0.5%.
Secondly the gas flow through safety valves was studied extensively. A BASF SV PN325 NW10 has been modeled with fixed opening assuming axi-symmetric flow. It is found that the choking area changes significantly when the pressure is increased to high values. Consequently the K_d factor cannot be assumed constant. Influences of pressure and gas type have been investigated. The numerically calculated K_d was compared with experimental data from the TÜV. In addition a sensitivity study was carried out to determine the parameters that influence K_d most.

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d.d. 13 april 2007