Opleiding Werktuigbouwkunde **Universiteit Twente**
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COLLOQUIUM

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Vakgroep: **Technische Stromingsleer**

In het kader van zijn doctoraalopdracht zal

Ulrich Sachs

een voordracht houden getiteld:

Evaluation of three Condensation Models for Transonic Flow

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Summary:
Flow-induced condensation is found in various industrial applications, ranging from steam turbines to supersonic gas conditioners. In these devices, the rapid flow expansion leads to the spontaneous nucleation and the formation of a dispersion of small liquid droplets. The evolution of the droplet dispersion is primarily governed by the so-called Kinetic Model (KM). The KM is a conservation law in phase space, which encompasses both the physical domain and the droplet size domain. In its most fundamental form, the KM describes the interaction between clusters of molecules (droplets) of different sizes, and reduces to the Kinetic Equation (KE) in the case of homogeneous nucleation. Assuming that the behavior of the droplet size distribution is quasi-steady, the KE may be approximated by a simplified model denoted as the Classical General Dynamic Equation (CGDE) which only considers droplets larger than the critical size. A third model is obtained in the form of a Fokker-Planck equation (FPE) by linearization of the KE.

In this investigation an evaluation is made of the KE, the FPE model and the CGDE, based on the application to two test cases. The first test case concerns a shock-tube problem, where only a one-way coupling between the vapor-phase and the droplet dispersion is used. The second test case concerns an expanding one-dimensional nozzle flow, for which both one-way and two-way coupling are used. The droplet size distributions obtained with the CGDE model and the FPE model are compared with those obtained with the KE, as the latter serves as the bench mark method. For the second test case, both the liquid mass fraction and the flow field variables obtained with each GDE-model are also compared with experimental data from the literature.

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