Opleiding Werktuigbouwkunde

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COLLOQUIUM

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Vakgroep: **Technische Stromingsleer**

In het kader van zijn doctoraalopdracht zal

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een voordracht houden getiteld:

Transpiration boundary condition for numerical study of unsteady 2D sheet cavitation on hydrofoils

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Summary
Cavitation occurs on blades of ship propellers and causes noise, vibration and erosion on the blades and nearby parts of the ship structure. In order to reduce these negative effects, the cavitation behavior must be better understood. In the STW project "The structure of unsteady 3D sheet cavitation", experiments have been carried out to investigate the influence of an unsteady inflow on a hydrofoil, specifically on the shedding behavior of sheet cavitaties, by placing flow oscillators upstream of the hydrofoil.

Goal of the present research is to model the effects of these flow oscillators in a Finite-Volume Method, developed in the Engineering Fluid Dynamics group, for numerically simulating flows with cavitation. A transpiration boundary condition is derived to represent the effects of the moving flow oscillators. Within this approach the flow oscillators do not actual move, instead a normal velocity is imposed at their surface, which results in a flow field that at some distance from the oscillator is comparable with the flow field around an actually moving oscillator. Because now a moving body-fitted mesh is not needed, the method is computationally less demanding and easier to use than a method with moving boundaries.

To assess the accuracy of this approximate method several test cases have been carried out. Obtained numerical results are validated employing numerical results for stationary airfoils at a slightly different angle of attack simulated by the transpiration boundary condition. Numerical results for oscillating airfoils are compared with analytical results from unsteady thin airfoil theory. Finally, the flow in the cavitation tunnel with the flow oscillators in front of a hydrofoil is simulated and effects of the generated unsteady inflow on sheet cavitation have been studied.

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