



COLLOQUIUM

Conform artikel 4.6.8 van het SSNS-wb.

Vakgroep: Technische Stromingsleer

In het kader van zijn doctoraalopdracht zal

Koen van Andel

een voordracht houden getiteld:

Particle Image Velocimetry of Flow Fields in a Centrifugal Pump Impeller

Datum: vrijdag 18 april 2008

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Samenvatting:

An optimized geometry of a centrifugal water pump impeller has been selected for experimental validation of results from COMPASS, a potential-flow based computational method for rapid estimates of the performance of a free impeller near design conditions.

A new test device has been realized and its constructional aspects have been documented and analyzed in detail in view of future application. Measurements have been performed using 2-D Particle Image Velocimetry. The flow velocities relative to the impeller, rotating at 150 rpm, have been determined at two planes between hub and shroud for several flow rates between 20% and 150% of the design flow rate.

Measurements and computations show fair overall agreement, but in the tests, wake regions appear near the shroud and the blade suction side. This is due to secondary flow of low-momentum fluid from the boundary layers, which is not accounted for in potential-flow theory.

The measurement quality and the behaviour of the test device as well as the observed flow phenomena have been studied extensively. The main problem is the inclusion of air bubbles, obstructing the measurements at speeds higher than 150 rpm. The non-uniform flow distribution in the impeller inlet tube and the possible presence of pre-swirl have unknown effects on the flow pattern in the impeller. The total cumulative error from determination of flow rate and rotational speed, calibration, alignment of the measurement optics and digital data correlation is estimated to be typically 5%. It is subject to future work to assess the nature and extent of these uncertainties in detail and to avoid bubble inclusion by optimizing the design of the test rig.

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