

**Title:** **Velocity Measurements in the Wake of an Azimuthing Thruster using PIV**

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### **Abstract**

The wake flow behind a ducted azimuthing thruster was investigated, both in open water conditions and with the thruster placed under a schematical barge. Model tests were carried out in stationary conditions. The propeller thrust and torque were recorded and the velocities in the wake of the thruster were measured using a PIV (particle image velocimetry) measurement system. The results of these measurements are used to validate and improve CFD calculations of the flow in the thruster wake. The measurements and CFD calculations are important to help understand thruster-interaction effects.

Detailed PIV measurements were carried out on the wake flow behind the thruster in open water conditions. The PIV system used can measure 3D velocities in a plane, illuminated by a laser light beam. The flow velocities were measured in a large number of cross sections at different distances from the thruster. In addition, velocities were measured in a longitudinal plane at the thruster centre line. An example of these measurement results are shown in the paper (Figure 1).

The PIV measurements provide a detailed image of the flow velocities in the thruster wake, showing the axial velocities, as well as the rotation and divergence of the wake. The measured wake velocities are compared with CFD calculations and the velocities described by an empirical model.

Subsequently, PIV measurements were carried out for the thruster placed under a barge. The measurement results show a thruster wake deformed by the presence of the barge above the thruster, as well as by the bilge radius of the barge. The bottom of the barge forms a flat plate above the thruster, clearly flattening the cross section of the thruster wake. In addition, the wake flow along the bottom and the bilge radius of the barge results in a low pressure region, causing the wake flow to diverge up as it flows from under the barge into the open water. This phenomenon is known as the Coanda effect and was clearly visible in the PIV measurements.

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