Universität Stuttgart

IWS Department of Hydraulic Engineering
and Water Resources Management
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B.Sc. / M.Sc. Topic
Design and evaluation of a single-camera, stereoscopic PIV system

Background

Accurate flow measurements are of importance for understanding of naturally-occurring processes such as sediment transport and exchange of nutrients and gases. Particle Image Velocimetry (PIV) is a well-established measurement technique, which is capable of providing high spatio-temporal measurements of velocity fields in a variety of environments. In a traditional PIV setup, a laser illuminates the particles seeded in fluids, and a camera obtains the particle images at successive time steps. A two-dimensional (2D) velocity field can then be computed through correlation-based analysis of the particles images. However, turbulence is inherently three-dimensional (3D) in nature, and comprises randomly varying and quasi-organized motions in space and time. Therefore, a better (or full) description requires measurements of 3D velocity fields. This is particularly important in an ongoing project in our department, focusing on biofilm-induced turbulence and sediment dynamics, in which understanding the evolution of flow topology and 3D coherent flow structures is essential.

We provide a Master's thesis opportunity for testing the feasibility of utilizing a single-camera for 3D PIV application, using special optical prisms and mirrors. The applicant will build on the existing PIV system and PIV code, and is expected to systematically test the performance of the upgraded PIV system for a variety of flow configurations.

Objectives

- Critical review of the literature on PIV techniques relevant to the research objective, and development of a work-plan.
- Development of a single camera, stereoscopic PIV (SPIV) system, and performance of preliminary tests.
- Incorporation of SPIV capability (e.g. calibration, warping, etc.) into the existing code.
- Performance of comparative experiments to evaluate the performance of the SPIV system.
- Comparison of flow statistics between the developed SPIV and a commercial SPIV system.

Your profile

- Knowledge and interest in experimental fluid mechanics and flow visualization
- Basic knowledge of geometrical optics
- Advanced programming skills in MATLAB or Python.

Apply now!

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Please send your CV and explain in a few lines why you are interested in this thesis project.

Examiner: Prof.-Dr. Ing. Silke Wieprecht (LWW) | Supervisor: Kaan Koca (LWW)