PhD@DICAM – 02 Ottobre 2023 ore 10:00; Aula M. Colonna, Via Terracini 28, Bologna

Lagrangian Methods for Flow Measurements

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Lagrangian methods are quite versatile and can be applied to various phenomena, including traffic flow, the fate of pollutants, species migration, and more. They enable the direct determination of the trajectories of individual elements such as cars, people, particles, etc.

In this seminar, we will delve into Lagrangian methods with a focus on their applications in fluid mechanics, where they are often referred to as Particle Tracking Velocimetry (PTV). PTV involves tracking individual particles that are seeded into the flow, and it serves as a proxy for determining the flow velocity. As PTV relies on the analysis of flow images, it can be considered a whole field technique, offering the ability to visualize and determine the flow field across a sizable section of the flow with a spatial resolution that can extend up to the diameter of the particles themselves.

During this seminar, we will take a hands-on approach, using an open surface flow example (flow around groins) to guide us step by step through the PTV process. We'll cover everything from the hardware requirements, the need for subpixel resolution to ensure accurate tracking, to consider the flow characteristics, image processing techniques for determining the velocity field, and the subsequent post-processing steps. Particular emphasis will be placed on the post-processing phase, including the extraction of a structured velocity field from an initially unstructured one, as well as the determination of flow statistics. At each stage, we will discuss both the strengths and limitations of PTV.

For this seminar, it is recommended that participants have a laptop with Matlab and the Image Processing Toolbox installed to fully engage in the hands-on component.

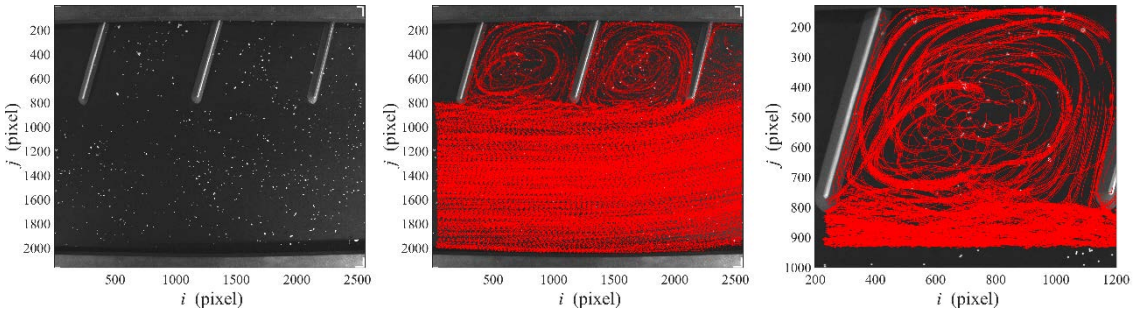

Figure 1: Flow around a system of groins, Laboratory of Hydraulics, Technical University of Munich. From left to right: seeded flow, whole field flow, zoom in the inter-groins region.

Rui Aleixo, PhD

Rui Aleixo finished his PhD in 2013 on the study of dam-break flow by means of non-intrusive techniques. He did a Post-Doc in the National Center for Computational Hydroscience of the University of Mississippi, USA and was a researcher at the University of Bologna from 2017 to 2019. He was the chair of the Experimental Methods and Instrumentation committee of the IAHR from 2015 to 2017 where he co-organized the W.A.T.E.R. Summer School. His main body of research is on experimental methods and experimental hydraulics and fluid mechanics. He is currently assistant professor at the Institute of Hydroengineering – Polish Academy of Sciences, in Gdansk, Poland.