

# PhD program in Civil, Chemical and Environmental Engineering

## Curriculum in Fluid Dynamics and Environmental Engineering

Academic year 2019/2020

### 1. Title of the course

Particle Image Velocimetry

### 2. Contents

The course will provide the basic elements regarding the Particle Image Velocimetry (PIV) technique and, in particular, will cover the following arguments:

- a) Introduction and brief history of the development of PIV
- b) Detailed description of the main part of PIV system: laser, digital cameras (ccd and cmos based), synchronization device, tracer particles and controlling software
- c) Image acquisition: the different protocol of acquisition will be described with a particular attention to their application depending on the experiments.
- d) Image analysis: starting from the mathematical background on auto and cross-correlation, we will explore the different approaches to produce velocity fields from the acquired images. The standard PIV approach will be described in details, whereas the most updated strategies will be briefly presented. The digital image analysis is presented following the main steps: image calibration, choice of the optimal cross-correlation parameters, algorithms for error check and vector replacement.
- e) Post processing of the measured velocity fields: in this section we discuss the post processing of the raw data, e.g. two dimensional velocity fields. In particular, the algorithm to evaluate differential and integral quantities, such as vorticity, flow eigenvalues, okubo-weiss parameter, swirling strength, circulation, will be presented

The course will be complemented with experimental activities.

### 3. Structure of the course

The course consists of frontal lectures and experimental activities.

### 4. Duration and credits

20 hours/4 credits

5. **Period and registration procedure**

January 2020. Registration procedure: email to [Alessandro.stocchino@unige.it](mailto:Alessandro.stocchino@unige.it)

6. **Deadline for registration**

End of December 2019

7. **Final exam**

Personal project based on a tutorial proposed by the teachers