

Thermal Measurements in Two-Phase Systems

Dr. Alekos I. Garivalis, PhD (alekos.garivalis@unipi.it)

Venue and date: **Biblioteca “Lorenzo Poggi”, DESTEC, Polo A**

- **September 20, 2024, 14:45-18:45**
- **September 27, 2024, 14:45-18:45**

One of the first tasks of a PhD student is to operate or set up an instrument to make measurements. A considerable amount of time is spent connecting sensors, programming acquisition software and learning how an instrument works. In addition, conducting experimental research requires a good level of confidence in troubleshooting and a minimal amount of experience with signals and electronics.

The course provides students with a basic knowledge of how to deal with measurements, with particular emphasis on measurements of important quantities of two-phase systems (e.g., liquid-vapour). Special emphasis is placed on thermal measurements (temperature and heat flux) with an overview of contact, non-contact and inverse techniques. Advanced flow and temperature visualisation techniques are also introduced.

Programme of the course:

1. 4 hours, September 20, 2024, 14:45-18:45

- a) Temperature measurements
- b) Heat flux measurements
- c) Inverse heat transfer problems (hints)
- d) Infrared thermography
- e) Liquid crystals
- f) Optical fibres

2. 4 hours, September 27, 2024, 14:45-18:45

- a) Pressure measurements
- b) Quality measurements
- c) Shadowgraphy, Schlieren, Interferometry
- d) Phase detection
- e) PIV, PTV...
- f) Laser induced fluorescence

Data acquisition and control with LabView

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- **October 11, 2024, 14:45-18:45**
- **October 18, 2024, 14:45-18:45**

Data from all sensors is usually digitised and collected by computer. The basis of digitisation and data acquisition is necessary for a good experimental activity. Nevertheless, experimental apparatus may have some components that can be controlled or automated (electric valves, triggers, pumps...). A common choice is to use the LabView software for both data acquisition and experiment control.

The course introduces the principles of digitisation, data acquisition and control. Different acquisition systems and communication protocols are described. The LabView software and the basics of programming are explained. The steps to create and manage a LabView project are shown, together with examples and real applications.

Programme of the course:

3. 4 hours, October 11, 2024, 14:45-18:45

- a) Principles of digitalization
- b) Current and voltage measurement
- c) Acquisition systems
- d) FPGA
- e) Control (PID, PWM)
- f) Introduction to LabView

4. 4 hours, October 18, 2024, 14:45-18:45

- g) Making a project in LabView Environment
- h) Examples of acquisition and control