

Title: Multiphase models for the dynamics of fluids

Teachers:

Michele Battistoni (University of Perugia, Italy)

Contact: michele.battistoni@unipg.it

Indicative period: June-July 2024

ABSTRACT:

Multiphase flows are widely used in a large variety of practical applications, such as spray, atomization, coatings, cavitation, phase change problems, cooling, microfluidics, in industrial and medical Engineering. The course aims at the introduction of mathematical methods and experimental tools for studying some classes of turbulent multiphase flows. Applications will be discussed and numerical algorithms for the solution of the governing equations will be presented.

PROGRAM:

Syllabus:

Basics of kinematics of fluid flows: Lagrangian and Eulerian descriptions of motion. Balance equations for mass, momentum, and energy. Constitutive theory of fluids. Derivation of the governing equations for multiphase flows in fluids.

Classifications: separate vs. dispersed flows. Dispersed flows: two-fluid and single-fluid Eulerian formulations, Lagrangian formulation. Models for unclosed terms. Separate flows: Eulerian formulation, models for unclosed terms.

Numerical methods for computational fluid dynamics (brief overview)

Case studies on both Eulerian and Lagrangian models using open-source CFD software (openFoam)

Case studies and applications, with an overview on high performance computing methods.