

Title: Multiphase models for the dynamics of fluids

Teacher: Battistoni, Vergori

Contact: michele.battistoni@unipg.it, luigi.vergori@unipg.it

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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 for studying some classes of multiphase flows of both incompressible and compressible fluids. 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. Cauchy stress tensor.

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)