

## **Mathematical and Numerical Models for the cardiovascular system**

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The school aims at addressing in a unified framework several aspects of the mathematical modelling and numerical simulation of the circulatory physiology. In particular we will address the electrical excitation of the heart, the related mechanical contraction, models for blood flow circulation and the transport of biochemicals.

Emphasis will be put on modelling aspects, the analysis of coupled system of PDEs, numerical approximation and algorithmic issues. In particular, we will address efficient methods for the incompressible Navier-Stokes equations, Arbitrary Eulerian Lagrangian formulation, numerical techniques for the dynamics of biological structures, coupling strategies for fluid structure interaction schemes, numerical schemes for the non linear reaction diffusion system governing the cardiac bio-electrical activity and domain decomposition techniques for their parallel implementation.

Beside traditional lectures, the school includes practical sections, organised with the aid of scientific software.

The course is addressed to researchers and graduate students in applied mathematics, as well as bioengineers and medical researchers interested in the numerical simulation aspects.

### **PREREQUISITES:**

Basic knowledge of numerical analysis of PDE and cognition of the finite element method.

### **REFERENCES:**

-A. Quarteroni, L. Formaggia, Mathematical Modelling and Numerical Simulation of the Cardiovascular System, in Handbook of Numerical Analysis (P.G Ciarlet Ed.), 3--129, Elsevier, Amsterdam, 2004

-Lecture notes distributed to the participants.