

# Numerical Modeling and Large-Scale Simulation of the Cardiac Electromechanics

*Introduce:*

**Dott.ssa Giulia GIANTESIO**

Università Cattolica del Sacro Cuore

*Interviene:*

**Dott. Luca DEDÈ**

MOX - Politecnico di Milano

*Abstract*

Simulating the cardiac function is a challenging task from the mathematical, numerical, and computational standpoints. This is mainly due to the multiphysics nature of the problem, which is indeed comprised of several core models: electrophysiology, mechanics (both in its passive and active components), valve dynamics, and fluid dynamics. Each of these models is intrinsically complex and features a wide range of spatial and temporal scales; these need to be suitably captured to correctly represent the mutual interactions of the heart components.

In this talk, we consider the mathematical and numerical modeling of the left ventricle by integrating state-of-the-art models for the electrophysiology, mechanical activation at the cellular level, and the passive mechanical response of the cardiac tissue, thus yielding a coupled electromechanical problem. We consider its spatial approximation by means of the Finite Element method and we propose and consider both monolithic and staggered approaches for the numerical coupling of the problem. In the monolithic case, we solve the corresponding discrete, large-scale problem by means of the GMRES method with a newly proposed physics-based preconditioner that exploits the coupling of the core models. We present and discuss numerical results - obtained in the high performance computing framework - for the electromechanical problem applied to patient-specific geometries of the left ventricle.

## Seminario

**Lunedì 19 febbraio 2018**

**Sala Riunioni, ore 11.30**

Via dei Musei 41 - Brescia

