



AMERICAN  
UNIVERSITY OF BEIRUT  
CENTER FOR ADVANCED  
MATHEMATICAL SCIENCES



## MATHEMATICAL BIOLOGY

# A VIRTUAL HEART: MATHEMATICAL AND NUMERICAL MODELS OF THE CARDIAC ELECTROMECHANICAL FUNCTION

THURSDAY, SEPTEMBER 22, 2022

5:00 pm (Beirut time) | ONLINE

The human heart is a sophisticated machine, finely tuned by millions of years of evolution, whose functional role is pumping the blood throughout to body cells, so that organs are supplied with oxygen and nutrients, while the metabolic waste is removed. In the context of cardiovascular research and computational medicine, mathematical and numerical models are increasingly recognized as valuable tools, with a twofold role. On the one hand, realistic and detailed *in silico* models of the heart can deepen the understanding of its function, help the interpretation of experimental observations and explain the subtle links between the organ-level emergent phenomena and the underlying biophysical mechanisms. On the other hand, patient-specific numerical simulations, which are increasingly becoming available, can provide clinicians with valuable quantitative information for improving patient care and with precious tools to support decision-making.

In this talk, I will present some recent advancements in the development of mathematical and numerical models describing the biophysical processes involved in the heart function at different spatial scales. I will focus on the challenges raised by the multi-physics and multi-scale nature of the processes involved, whereby the different spatial and temporal scales are intertwined by a complex network of interactions and feedbacks, which are crucial for the proper functioning and regulation of the cardiac function.



**FRANCESCO REGAZZONI**  
Polytecnico di Milano, Italy

Francesco Regazzoni got his PhD from Politecnico di Milano, under the supervision of Prof. Alfio Quarteroni. He has been a visiting scholar at Inria Saclay Île-De-France, Pennsylvania State University and University of Graz. He is currently Junior Assistant Professor in Numerical Analysis at Politecnico di Milano. His research interests cover the mathematical modeling and numerical approximation of multiscale problems, in particular related to cardiovascular modeling, and the synergies between Machine Learning and Numerical Analysis. He has been awarded several international prizes, including the ECCOMAS Best PhD Thesis Award and the VPH Young Investigator Award.