

## **Image-based and data-integrated computational analyses for cardiac electro-physiology, hemodynamics, and perfusion**

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**Abstract:** We present here three examples of cardiac applications where medical data are used in strong synergy with computational methods to study problems of clinical relevance. First, we consider the analysis of the performance of the Cardiac Resynchronization Therapy (CRT), where geometric data from MRI and electrical data from Electrical Anatomical Mapping Systems are used to calibrate and validate the computational model and to create virtual scenarios of CRT for a comparison and a possible improvement of the therapy. Second, we consider time-resolved cine-MRI images of heart and valves to build geometries and motion of the cardiac chambers to be used in a computational fluid-dynamics study, where the motion of walls and valve is prescribed. In particular, we will focus on mitral regurgitation. Finally, Blood Flow Maps of cardiac perfusion are used to calibrate a perfusion mathematical and computational model for the non-invasive prediction of blood flow at the myocardial level.