A physiologically valid 3D-0D model of left atrial electromechanics

Speaker: Christoph Augustin, Medical University of Graz

Abstract: Image-based cardiac electromechanical (EM) models are valuable for understanding cardiac function in both normal and pathological conditions, aiding in diagnosis and therapy planning. Overcoming methodological challenges is crucial for advancing these models. This includes improving computational efficiency and robustness for model personalization and prolonged simulations under diverse conditions. Additionally, achieving physiological completeness with therapy-relevant mechanisms enhances predictive capabilities.

In this talk we focus on left atrial EM and present a modeling framework that integrates a 3D EM model with the physiologically comprehensive 0D CircAdapt model for closed-loop circulation. We show that the model successfully replicates physiological behaviors, responding to alterations in loading conditions and contractility induced by experimental protocols. Furthermore, the framework proves applicable to various clinically relevant problems.

The framework's mechanistic completeness and efficiency make advanced left atrial EM modeling applications feasible. It enables the exploration of parameter spaces over prolonged periods, crucial for personalized modeling. The model's reliability in predicting acute transient responses to interventions underscores its utility in clinical scenarios.