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Computational Modelling of the Infarcted Left Ventricle of the Heart

Myocardial infarction is an increasing health problem worldwide. The reason for a myocardial infarction is an occlusion of a coronary artery what causes an under-supply to the heart region nearby. In consequence, heart cells in this region permanently lose their ability to contract which, in turn, is gradually weakening the overall heart function. Existing therapeutic methods are not yet adequate to improve the situation, but not as much as desired. The project "Computational Mechanics and Electro-elasticity Towards Improved Understanding of the Biomechanics of Myocardial Infarction and the Development of Novel Therapies" aims at developing a computational model of the left ventricle of the heart which accounts for its electrophysiological and mechanical behaviour. In particular, this includes the activation of active contraction varying in time and space as well as the passive orthotropic material behavior of myocardial muscle fibre tissue. The description of active contraction stress needs to combine electrophysiological processes on cellular level as well as mechanical deformation of the muscle fibres. A sufficiently accurate model is the basis for obtaining a better understanding of the heart mechanics, in particular, how myocardial infarction affects its pumping performance and ultimately helps to design suitable therapeutic methods.