Estimation of conductivities in a bidomain-torso system by a variational approach

M. Mahjoub [a]

a. University of Tunis El Manar, National Engineering School of Tunis, Tunisia,
moncef.mahjoub@enit.utm.tn

Abstract

An accurate estimation of cardiac conductivities is critical in computational electro- cardiology, yet experimental results in the literature significantly disagree on the values and ratios between longitudinal and tangential coefficients. Knowledge of true values of conductivities is a very desirable feature for validation with in vitro experiments. In this work, we present an optimal control formulation for the bidomain model in order to estimate the heart-torso conductivity parameters. We consider a variational data assimilation approach to estimating those parameters. We consider the parameters as control variables to minimize the mismatch between the computed and the observed potentials under the constraint of the complete bidomain-torso model where the control acts at the boundary of the torso and in subdomain of the tissue domain. The existence of a minimizer of the misfit function is proved with the pathalogical phase-I Luo-Rudy ionic model, that completes the bidomain-torso system. The core of our numerical results is on 2D real geometries. We demonstrate the reability and the stability of the conductivity estimation approach in the presence of noise by presenting some numerical examples.