

Recent progress on homogenization of the bidomain and tridomain models in electrocardiology

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Abstract

At the microscopic level, cardiac tissue is very complex and it is therefore very difficult to understand and predict its behavior at the macroscopic (observable) scale. To each cardiac system, we associate a microscopic model (of elliptic type), coupled to a nonlinear ODE system and another microscopic one (dynamical boundary condition). Based on Ohm's law of electrical conduction and conservation of electrical charge, we obtain the microscopic model that gives a detailed description of the electrical activity in the cells responsible for cardiac contraction. Then, using homogenization techniques (based on unfolding operators), we obtain the macroscopic model which, in turn, allows us to describe the propagation of electrical waves in the entire heart.