Titre: STOCHASTIC ELECTROMECHANICAL BIDOMAIN MODEL IN ELECTROCARDIOLOGY

Abstract: We analyze a system of nonlinear stochastic partial differential equations (SPDEs) of mixed elliptic-parabolic type that models the propagation of electric signals and their effect on the deformation of cardiac tissue. The system governs the dynamics of ionic quantities, intra and extra-cellular potentials, and linearized elasticity equations. We introduce a framework called the active strain decomposition, which factors the material gradient of deformation into an active (electrophysiology-dependent) part and an elastic (passive) part, to capture the coupling between muscle contraction, biochemical reactions, and electric activity. Under the assumption of linearized elastic behavior and a truncation of the nonlinear diffusivities, we propose a stochastic electromechanical bidomain model, and establish the existence of weak solutions for this model. To prove existence through the convergence of approximate solutions, we employ a stochastic compactness method in tandem with an auxiliary non-degenerate system and the Faedo–Galerkin method. We utilize a stochastic adaptation of de Rham's theorem to deduce the weak convergence of the pressure approximations.