

Modified Fletcher-Reeves and Dai-Yuan Conjugate Gradient Methods for Solving Optimal Control Problem of Monodomain Model

Abstract

In this paper, we present the numerical solution for the optimal control problem of monodomain model with Rogers- modified FitzHugh-Nagumo ion kinetic. The monodomain model, which is a well-known mathematical model for simulation of cardiac electrical activity, appears as the constraint in our problem. Our control objective is to dampen the excitation wavefront of the transmembrane potential in the observation domain using optimal applied current. Various conjugate gradient methods have been applied by researchers for solving this type of optimal control problem. For the present paper, we adopt the modified Fletcher-Reeves method and modified Dai-Yuan method for computing the optimal applied current. Numerical results show that the excitation wavefront is successfully dampened out by the optimal applied current when the modified Fletcher-Reeves method is used. However, this is not the case when the modified Dai-Yuan method is employed. Numerical results indicate that the modified Dai-Yuan method failed to converge to the optimal solution when the Armijo line search is used.