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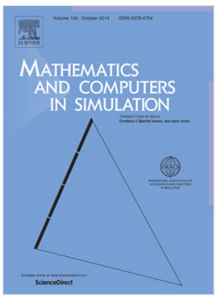

Numerical solutions of equations of cardiac wave propagation based on Chebyshev multidomain pseudospectral methods

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Numerical Solutions of Equations of Cardiac Wave Propagation based on Chebyshev Multidomain Pseudospectral Methods.

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Abstract

The numerical solution of equations that model the propagation of action potentials in cardiac tissue is a very hard computational problem. Multiple temporal scales arising from the local nonlinear changes in the membrane voltage joined to stiffness of the diffusion operator, results in a phenomenon that evolves in a multiple spatio-temporal scale. Due to this fact, the solution of such equations in two and three dimensions can be very time and memory consuming. In this work, we present basic explicit, implicit and semi-implicit schemes based on Chebyshev Multidomain Pseudospectral approach; some advantages and disadvantages for each of them and estimates on the computing time to obtain approximated solutions. With the obtained results, we conclude that the semi-implicit Chebyshev-Multidomain is the best alternative to solve these kind of equations. The combination between the number of points and the size time step provides the most accurate and fast scheme when solving cardiac systems based on the Hodgkin-Huxley formalism.

Keywords: Chebyshev-Pseudospectral, Cardiac Wave Propagation, Reaction-Diffusion

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