Title: **A Multiresolution Space-Time Adaptive Scheme for the Bidomain Model in Electrocardiology.**

Author: **Bendahmane, M., Bürger, R. and Ruiz-Baier, R.**

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Review by: Mario Forcinito

In the study of the electric activity in cardiac tissue, researchers have developed a model based on the principle of conservation of current between the intra- and extracellular domains. This model is know as the *bidomain model* and it is considered as one of the most accurate and complete models for the theoretical and numerical study of the electrodynamics of cardiac tissue.

From a mathematical point of view the interesting features of this model arise from its complex structure, a system consisting of a scalar (degenerate in some cases) parabolic PDE for the transmembrane potential that is coupled with a scalar elliptic PDE for the extracellular potential. These are supplemented by a time-dependent ODE for the gating variable, defined at every point of the domain. The need for 2 coupled PDE's stems from the physical characteristic of the tissue itself as intra- and extracellular tissues have, in general, different longitudinal and transversal conductivities (a simplified system for the case in which the two are the same is known as the *monodomain model* and for this case the elliptic PDE reduces to an algebraic equation).

This paper presents advances in the numerical solution of the equations for the bidomain model, the solutions of which tend to develop sharp excitation fronts of rapidly changing time-scales. Adaptive (in space and time) grids and/or front tracking mechanism are a must for the efficient computer solution of this type of problems. In this case, the authors advance a fully adaptive multiresolution (MR) scheme with locally varying space-time stepping (LTS) and adaptive time step control by means of a Runge-Kutta-Fehlberg (RKF) method for the numerical solution.

Several examples of solution for the monodomain and bidomain models are provided to show the efficiency gains provided by the proposed approach.

See also

- Fenton et al. *Termination of Atrial Fibrillation Using Pulsed Low-Energy Far-Field Stimulation*, available on-line at:
  `http://thevirtualheart.org/FentonCherry/pdf/circulation_low_energy.pdf`