An Optimal Control Approach to Cardiac Electrophysiology

K. Kunisch[1], C. Nagaiah[2], G. Plank[3] and M. Wagner[4]

Abstract: The bidomain equations are an accepted model for the electro-physiological activity of the heart. To describe the influence of extracellular current density stimulus and to deterine its optimal intensity as a function of time (and space) an optimal control problem is formulated and analysed. A well-posedness theory for the primal and adjoint equations is provided, and necessary optimality conditions are proven in a function space setting. Aspects of the numerical realisation based on nonlinear CG and Newton methods are discussed and numerical examples demonstrating the capability of termination of reentry phenomena are presented.

[1,2] Institute for Mathematics and Scientific Computing
University Graz
Heinrichstrasse 36, 8010 Graz, Austria
karl.kunisch@uni-graz.at, nagaiah.chamakuri@uni-graz.at

[3] Institute for Biophysics, Med. University Graz
Harrachgasse 21/IV, 8010 Graz, Austria
gernot.plank@medunigraz.at

[4] Mathematical Institute, University of Leipzig
Johannisgasse 26, 04103 Leipzig, Germany
marcus.wagner@math.uni-leipzig.de