Einladung zum Vortrag

Whole heart cardiac electrophysiology: Simulation Methods and Validation Criteria

Professor William S. Klug, Ph. D.
Mechanical and Aerospace Engineering,
UCLA, Los Angeles, USA

A necessary precondition for predictive patient-specific computational models of cardiac biomechanics is the verification and validation of patient-*invariant* models. We describe a sequence of methods that begin with cardiac ventricular tissue, and produce a partial differential equation model of the electrical activation of the lower heart. Anatomy and cardiac microstructure are obtained from diffusion tensor magnetic resonance imaging, and are interpolated into a numerical Finite Element Model (FEM). To solve the extremely stiff governing equations, we present an integration framework that uses operator splitting and asynchronous adaptive time stepping tailored to their spatiotemporal multiscale character. We also include transmural and apico-basal gradients of action potential characteristics in our model, as well as Purkinje structure (specialized conduction system) to achieve physiological activation. From this model we computed a 6-lead (precordial) ECG and also time activation sequences. We are particularly concerned with the question of the validation of the various methods. For each type of output, we state criteria that any successful simulation must meet. We conclude that a Purkinje geometry with a high density of Purkinje muscle junctions covering the right and left ventricular endocardial surfaces, as well as transmural and apico-basal gradients in action potential characteristics, are necessary to produce ECGs and time activation plots that agree with physiological observations.

Dienstag, 9. Juli 2013 **11:00 Uhr**
MW 2250 **Maschinenwesen, Boltzmannstr. 15, 85748 Garching**

Lehrstuhl für Numerische Mechanik • Prof. Dr.-Ing. W. A. Wall • TU München •
Boltzmannstr. 15 • D-85747 Garching b. München • Tel 089-289-15300
http://www.lnm.mw.tum.de/dates-and-events/presentations/acm/

Advances in Computational Mechanics

Lecture series / Vortragsreihe
Institute for Computational Mechanics /
Lehrstuhl für Numerische Mechanik