



JOHNS HOPKINS



BIOMEDICAL ENGINEERING GUEST SEMINAR

Wednesday, March 18, 2009

1:00 PM in CSEB Auditorium, Homewood Campus



UT-Heart: Multi-scale, multi- physics heart simulator of the University of Tokyo

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Abstract: To promote our understanding on the normal and abnormal function of the heart by integrating our knowledge collected at the molecular and the cellular levels, we have developed a multi-scale and multi-physics computer simulation of the heart. This simulator based on the finite element method, consists of approximately 0.6 million elements for mechanical computation and 20 million elements for electrophysiology and mathematical models of cardiac excitation-contraction process are implemented in each element. Its morphology was based on the multi-detector CT data and now has both ventricles and atria with aortic arch. In this model, fiber orientation was mapped and the conduction system was modeled with characteristic electrophysiology. Upon stimulation applied to the pacemaker site, excitation propagates to the adjacent elements resulting in the synchronous contraction and relaxation of the heart. In addition, because fluid part representing the blood was also modeled and solved simultaneously with the structural part by the strong-coupling method, we can reproduce the blood flow in the atria, ventricles and aorta. Such features of the simulator enable us to extract various data and present them as we do in the clinical laboratories. These data includes ECG, UCG, Doppler ECG, Magneto-cardiogram etc. In the presentation, we will show some preliminary data on diseased heart model.

<http://www.sml.k.u-tokyo.ac.jp/>

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