Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Automated Tuning for Parameter Identification in Multi-Scale Coronary Simulations JUSTIN TRAN, DANIELE SCHIAVAZZI, ABHAY RAMACHANDRA, Stanford University, ANDREW KAHN, University of California, San Diego, ALISON MARSDEN, Stanford University — Computational simulations of coronary flow can provide non-invasive information on hemodynamics that can aid in disease research. In this study, patient-specific geometries are constructed and combined with finite element flow simulations using the open source software SimVascular. Lumped parameter networks (LPN), consisting of circuit representations of hemodynamic behavior, can be used as coupled boundary conditions for the flow solver. The parameters of the LPN are tuned so the outputs match a patient's clinical data. However, the parameters are usually manually tuned, which is time consuming and does not account for uncertainty in the measurements. We thus propose a Bayesian approach to parameter tuning that provides optimal parameter statistics through sampling from their posterior distribution and is particularly well suited for models characterized by a large number of parameters and scarce data. We also show that analysis of the local and global identifiability play an important role for dimensionality reduction in the estimation. We present the results of applying the proposed approach to a cohort of patients, and demonstrate the ability to match high priority targets. After identifying the LPN parameters for each patient, we demonstrate their use in 3D simulations.

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Date submitted: 31 Jul 2015 Electronic form version 1.4