Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Automated tuning for parameter identification in multiscale coronary simulations JUSTIN TRAN, DANIELE SCHIAVAZZI, ABHAY RAMACHANDRA, ANDREW KAHN, ALISON MARSDEN, Univ of California - San Diego — Computational simulations of coronary flow can provide non-invasively obtained information on hemodynamics and wall mechanics that can aid in treatment planning and improve understanding of disease progression. In this study, patient-specific geometry of the aorta and coronary arteries is constructed from CT scans and combined with finite element flow simulations. Lumped parameter networks are coupled as boundary conditions at the inlet and outlets and calculate global hemodynamic quantities. These tools have potential for clinical impact in identifying optimal geometries for Coronary Artery Bypass Grafts, in determining the risk of re-stenosis in saphenous vein grafts, or for studying other coronary diseases. Despite advances in simulation methods, clinical adoption of these tools is currently hindered by the lack of tools for uncertainty quantification. In current simulations, results are reported as single values without confidence intervals. These simulations also do not account for uncertainties in modeling assumptions, nor the uncertainties in the clinical measurements. This study will take the first step in quantifying these uncertainties. Distributions of the modeling parameters will be inferred through inverse Bayesian estimation and propagated through the model to determine parameter sensitivity and quantify confidence in simulation results. Quantification of these uncertainties is a crucial step towards acceptance of coronary flow simulations in the clinical community.

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Date submitted: 01 Aug 2014 Electronic form version 1.4