

Abstract Submitted
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**Optimal shape design for cardiovascular surgery applications
in the presence of uncertainties: a stochastic derivative-free approach**

SETHURAMAN SANKARAN, UCSD, JEFFREY FEINSTEIN, Stanford University, ALISON MARSDEN, UCSD — In the field of cardiovascular medicine, predictive finite element simulations that compute the hemodynamics of blood flow, particle residence times, as well as shear stresses induced on arterial walls could aid in surgical intervention. These simulations lack accurate input data and are often polluted with uncertainties in model geometry, blood inlet velocities and outlet boundary conditions. We develop a robust design framework to optimize geometrical parameters in cardiovascular simulations that accounts for diverse sources of uncertainties. Stochastic cost functions are incorporated into the design framework using their lower order statistical moments. The adaptive stochastic collocation technique embedded within a derivative-free optimization technique is employed. Numerical examples representative of cardiovascular geometries, including robust design on various anastomoses is presented and the efficiency of the adaptive collocation algorithm is shown.

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