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Optimization of an idealized Y-Shaped Extracardiac Fontan Baffle[1] WEIGUANG YANG, UCSD, JEFFREY FEINSTEIN, V. MOHAN REDDY, Stanford University, ALISON MARSDEN, UCSD — Research has showed that vascular geometries can significantly impact hemodynamic performance, particularly in pediatric cardiology, where anatomy varies from one patient to another. In this study we optimize a newly proposed design for the Fontan procedure, a surgery used to treat single ventricle heart patients. The current Fontan procedure connects the inferior vena cava (IVC) to the pulmonary arteries (PA's) via a straight Gore-Tex tube, forming a T-shaped junction. In the Y-graft design, the IVC is connected to the left and right PAs by two branches. Initial studies on the Y-graft design showed an increase in efficiency and improvement in flow distribution compared to traditional designs in a single patient-specific model. We now optimize an idealized Y-graft model to refine the design prior to patient testing. A derivate-free optimization algorithm using Kriging surrogate functions and mesh adaptive direct search is coupled to a 3-D finite element Navier-Stokes solver. We will present optimization results for rest and exercise conditions and examine the influence of energy efficiency, wall shear stress, pulsatile flow, and flow distribution on the optimal design.

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