Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

High Order Large Eddy Simulation (LES) of Flow in Idealized Total Cavopulmonary Connection (TCPC) YANN DELORME, KAMESWARARAO ANUPINDI, DINESH SHETTY, ANNA-ELODIE KERLO, JUN CHEN, School of Mechanical Engineering, Purdue University, MARK RODEFELD, Indiana University School of Medicine, STEVEN FRANKEL, School of Mechanical Engineering, Purdue University — Irregular, transitional, and chaotic flow fields have been observed in previous experimental studies of the TCPC. Low-order numerical methods have been shown to be unable to capture these unsteady flow structures when compared to experimental flow studies. A high-order incompressible LES code is combined with a recent Immersed Boundary Method (IBM) to enable structured Cartesian grids to represent the TCPC geometry. Validation studies for canonical flows and recent PIV data for the TCPC case are shown. Analysis of the instantaneous vortical structure and mean statistics are presented to further elucidate the complex flow patterns and wall shear stress distributions. Recent studies proved that mechanical support through a Viscous Impeller Pump (VIP) can improve TCPC hemodynamics by increasing the pressure and the blood flow through the lungs. The inclusion of this novel VIP to power the Fontan circulation is also studied with further comparisons to PIV and HQ data. Finally, dynamic mode decomposition is used to study TCPC flow modes and particle transport is considered to assess thrombosis potential.

Yann Delorme
School of Mechanical Engineering, Purdue University

Date submitted: 19 Aug 2011 Electronic form version 1.4