Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Fluid flow and dissipation in intersecting counter-flow pipes
KEREM PEKKAN, PRASAD DASI, CHANG WANG, DIANE DEZELICOURT, FOTIS SOTIROPOULOS, AJIT YOGANATHAN, Georgia Institute of Technology — Intersecting pipe junctions are common in industrial and biomedical flows. For the later application, standard surgical connections of vessel lumens results a "+" shaped topology through a side-to-side or end-to-side anastomosis. Our earlier experimental/computational studies have compared different geometries quantifying the hydrodynamic power loss through the junction where dominant coherent structures are identified. In this study we have calculated the contribution of these structures to the total energy dissipation and its spatial distribution in the connection. A large set of idealized models are studied in which the basic geometric configuration is parametrically varied (from side-to-side to end-to-side anastomosis) which quantified the strength of the secondary flows and coherent structures as a function of the geometric configuration. Steady-state, 3D, incompressible computations are performed using the commercial CFD code FIDAP with unstructured tetrahedral grids. Selected cases are compared with the in-house code results (in Cartesian and structured grids). Grid verification and experimental validation with flow-vis and PIV are presented. Identifying the dissipation hot-spots will enable a targeted inverse design of the junction by reducing the degree of optimization with a focused parameter space.

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Date submitted: 10 Aug 2005 Electronic form version 1.4