

Characterizing hemodynamic conditions using dynamical systems methods

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Recent advances in blood flow modeling have led to highly-resolved, 4-dimensional data of hemodynamics. The motivation for such modeling is often to better understand how flow conditions affect health and disease, or to evaluate interventions that affect, or are affected by, blood flow mechanics. Vessel geometry and the pulsatile pumping of blood often leads to complex flow, which has been difficult to characterize. This talk will discuss a computational framework to better characterize local transport phenomena in the cardiovascular system. In particular, we compute Lagrangian coherent structures (LCS) to characterize flow stagnation, flow separation, partitioning of blood to downstream vessels, and mechanisms governing stirring and mixing in several diverse vascular models. This perspective enables unprecedented insight into clinically-relevant transport problems.