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A non-discrete method for residence time calculation as an indicator of thrombus formation in cardiovascular applications MAHDI ESMAILY MOGHADAM, ALISON MARSDEN, University of California San Diego — Cardiovascular simulations provide a promising means to predict risk of thrombosis in grafts, devices, and surgical anatomies in adult and pediatric patients. Although the pathways for platelet activation and clot formation are not fully understood, recent findings suggest that thrombosis risk correlates with the presence of recirculation regions with high residence time (RT). Current approaches for calculating RT are often based on releasing a finite number of Lagrangian particles in the flow and calculating RT by tracking their pathways. However, this method requires several simulations for a single case study, each of which requires releasing a significant number of particles, to obtain temporal and spatial convergence. In this work, we introduce a new non-discrete method, in which RT is calculated in an Eulerian non-discrete framework, using the advection-diffusion equation. Starting with an existing and a newly developed intuitive definition for the RT, the formulation for calculating RT in a region of interest is presented. The physical significance and sensitivity of each measure of RT is discussed and an extension of these definitions to a point-wise value is presented. Application to simulations of shunt insertion for single ventricle heart patients is demonstrated.

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