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Reduced order modeling of pulsatile blood flow: multistage dynamic mode decomposition with control MILAD HABIBI, Northern Arizona University, SCOTT DAWSON, Illinois Institute of Technology, AMIRHOSSEIN ARZANI, Northern Arizona University — Dynamic mode decomposition (DMD) has emerged in recent years as a purely data-driven technique to reduce snapshots of data to a best-fit linear reduced order model. Direct application of DMD to pulsatile cardiovascular flows is challenging. First, the unsteady nature of the input blood flow rate needs to be accounted for. Second, the flow topology can vary noticeably in different phases of the cardiac cycle. To overcome these challenges, we propose a new multistage dynamic mode decomposition with control (mDMDc) technique. The heart is considered as a controller, and the pulsatile inlet flow rate is the input to our system. Blood flow data are divided between different phases of the cardiac cycle and DMD with control is applied to each phase. We apply mDMDc to patient-specific computational fluid dynamics data (velocity and wall shear stress vectors) in cerebral aneurysm and coronary artery stenosis models. Reconstruction errors are presented and different modes are compared between velocity and wall shear stress.

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