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GPU-accelerated Lattice Boltzmann method for anatomical extraction in patient-specific computational hemodynamics H. YU, Mechanical Engineering, IUPUI, IN, Z. WANG, Computer Science, Kent State University, OH, C. ZHANG, Resources and Environmental Science, Wuhan University, China, N. CHEN, Mechanical Engineering, IUPUI, Indianapolis, IN, Y. ZHAO, Computer Science, Kent State University, OH, A.P. SAWCHUK, M.C. DALSING, Vascular Surgery, School of Medicine, Indiana University, IN, S.D. TEAGUE, Radiology and Imaging Sciences, School of Medicine, Indiana University, IN, Y. CHENG, Resources and Environmental Science, Wuhan University, China — Existing research of patient-specific computational hemodynamics (PSCH) heavily relies on software for anatomical extraction of blood arteries. Data reconstruction and mesh generation have to be done using existing commercial software due to the gap between medical image processing and CFD, which increases computation burden and introduces inaccuracy during data transformation thus limits the medical applications of PSCH. We use lattice Boltzmann method (LBM) to solve the level-set equation over an Eulerian distance field and implicitly and dynamically segment the artery surfaces from radiological CT/MRI imaging data. The segments seamlessly feed to the LBM based CFD computation of PSCH thus explicit mesh construction and extra data management are avoided. The LBM is ideally suited for GPU (graphic processing unit)-based parallel computing. The parallel acceleration over GPU achieves excellent performance in PSCH computation. An application study will be presented which segments an aortic artery from a chest CT dataset and models PSCH of the segmented artery.

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