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Parallel Computation of Airflow in the Human Lung Model TAE-HUN LEE, CHING-LONG LIN, Department of Mechanical and Industrial Engineering, IIHR - Hydroscience & Engineering , The University of Iowa, Iowa City, Iowa 52242, MERRYN TAWHAI, Bioengineering Institute, University of Auckland, Auckland, New Zealand, ERIC. A. HOFFMAN, Departments of Radiology and Biomedical Engineering, University of Iowa College of Medicine, Iowa City, Iowa 52242 — Parallel computations of airflow in the human lung based on domain decomposition are performed. The realistic lung model is segmented and reconstructed from CT images as part of an effort to build a normative atlas (NIH HL-04368) documenting airway geometry over 4 decades of age in healthy and disease-state adult humans. Because of the large number of the airway generation and the sheer complexity of the geometry, massively parallel computation of pulmonary airflow is carried out. We present the parallel algorithm implemented in the custom-developed characteristic-Galerkin finite element method, evaluate the speed-up and scalability of the scheme, and estimate the computing resources needed to simulate the airflow in the conducting airways of the human lungs. It is found that the special tree-like geometry enables the inter-processor communications to occur among only three or four processors for optimal parallelization irrespective of the number of processors involved in the computation.

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