

Fluid Flow Visualization of Biological Processes in Three Dimensional Space

Modeling and simulation play an important role in allowing scientists and physicians to see and interpret results of computational simulations for treatment planning and improved medical care. In particular, the on-going Virtual Soldier Project research, supported by Defense Advanced Research Projects Agency, is making efforts to visualize the entire human body and its biological processes. In the current phase of the project, research is being geared toward visualizing the heart. The particular subtask being undertaken is to visualize fluid flow through the pulmonary airways and blood flow in a large artery. The pulmonary flow studies were previously obtained from finite element simulation of a 3-D geometrical model made up of six airway branches (generations). The cardiovascular arterial model consists of a single axisymmetric tube with elastic walls. Currently, the blood flow in the latter model is computed in two spatial dimensions. Results will be visualized in 3-D using rotation around the axis of flow. Data is inputted using the HDF5 file format (Hierarchical Data Format), a file format for large datasets and data groups. The HDF5 files will then be used in SCIRun to visualize three dimensional flow. SCIRun is a problem solving data flow visualization software package created by the University of Utah's SCI Institute. It has an extensible package, Fusion, that can read in HDF5 files. A network of modules within SCIRun and Fusion will be created so that the HDF5 data can be converted into readable files for SCIRun. Users can then interactively explore scalar and vector flow fields with this SCIRun network.

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