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Low-Dimensional Models for Physiological Systems: Nonlinear Coupling of Gas and Liquid Flows A.E. STAPLES, E.S. ORAN, J.P. BORIS, K. KAILASANATH, Laboratory for Computational Physics and Fluid Dynamics, Naval Research Laboratory — Current computational models of biological organisms focus on the details of a specific component of the organism. For example, very detailed models of the human heart, an aorta, a vein, or part of the respiratory or digestive system, are considered either independently from the rest of the body, or as interacting simply with other systems and components in the body. In actual biological organisms, these components and systems are strongly coupled and interact in complex, nonlinear ways leading to complicated global behavior. Here we describe a low-order computational model of two physiological systems, based loosely on a circulatory and respiratory system. Each system is represented as a one-dimensional fluid system with an interconnected series of mass sources, pumps, valves, and other network components, as appropriate, representing different physical organs and system components. Preliminary results from a first version of this model system are presented.

A. E. Staples
Laboratory for Computational Physics and Fluid Dynamics,
Naval Research Laboratory

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