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Control volume based hydrocephalus research; a phantom study
BENJAMIN COHEN, RPI, ABRAM VOORHEES, Siemens Medical Imaging, JOSEPH MADSEN, Harvard Medical School, TIMOTHY WEI, RPI — Hydrocephalus is a complex spectrum of neurophysiological disorders involving perturbation of the intracranial contents; primarily increased intraventricular cerebrospinal fluid (CSF) volume and intracranial pressure are observed. CSF dynamics are highly coupled to the cerebral blood flows and pressures as well as the mechanical properties of the brain. Hydrocephalus, as such, is a very complex biological problem. We propose integral control volume analysis as a method of tracking these important interactions using mass and momentum conservation principles. As a first step in applying this methodology in humans, an *in vitro* phantom is used as a simplified model of the intracranial space. The phantom's design consists of a rigid container filled with a compressible gel. Within the gel a hollow spherical cavity represents the ventricular system and a cylindrical passage represents the spinal canal. A computer controlled piston pump supplies sinusoidal volume fluctuations into and out of the flow phantom. MRI is used to measure fluid velocity and volume change as functions of time. Independent pressure measurements and momentum flow rate measurements are used to calibrate the MRI data. These data are used as a framework for future work with live patients and normal individuals. Flow and pressure measurements on the flow phantom will be presented through the control volume framework.

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