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A Simplified Model for the Motion of the Brain Matter in Response to Translational Impacts to the Head[1] JI LANG, QIANHONG WU, Villanova University — A simplified mathematical model is developed to simulate the motion of the brain matter as our head is exposed to sudden external impacts. During the process, the cerebrospinal fluid in the subarachnoid space behaves as a squeeze damper to provide protection to the brain matter. The problem involves a solid object bathed in a liquid environment and enclosed in a container. The relative motion of the object to the container causes a squeezing flow on one side of the object, and a reverse squeezing flow on the other side. A simplified theoretical model is developed in which both the inner object and the outer container are modeled as cylinders of different sizes. A constant acceleration is imposed on the container. The pressurization of the fluid and the resultant motion of the inner object is analytically predicted and validated using Ansys CFX. The result shows that the relative motion of the inner object is very sensitive to the gap thickness and the density difference between the object and the surrounding liquid. The squeezing damping effect can effectively prevent the direct contact between the solid object and the container.

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