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APPLICATION OF TORSIONAL STRESSES ON VISCOUS AND NEWTONIAN FLUIDS IN MICROGRAVITY – A PROPOSAL FOR A NOVEL ROUTE

Abstract

The objective of this paper is to make an analytical study of viscous and Newtonian fluids with respect to their lamina movements. This is carried out along with their microstructural changes in their plane, when the fluids are subjected to torsional stresses in microgravity. Due to the presence of gravity, fluids on Earth cannot be subjected to certain stress methods such as torsional stresses, which are typically associated to solids . In the presence of microgravity, fluids having different Reynolds numbers do not tend to flow in the same manner as under the influence of gravity, yet have cohesive internal forces between their laminae.

With fluids of different viscosities and Reynolds Numbers, it is possible to conceive a system of two plates separated by a known pre-established distance in which a defined quantity of fluid can be applied. On separation of the plates, the fluid will form a stretched column, which can undergo torsional stresses due to relative twisting of the plates. Both the twisting angle and speed of rotation are designed to be controllable. This shall lead to the formation of a twisted column of fluid and the properties of the twist will change depending upon the viscosity of the fluid. This allows the measurement of new properties including the modelling of the stress tensor of the Newtonian fluid and shear stresses across the laminae. Further study will lead to an improved understanding of fluid dynamics and its structural integrity that might push the limits for its use in space flights. This novel route to study application of torsional stresses on viscous and Newtonian fluids can help in raising the bar for the advancements in fluid dynamics. With this method, fluids can replace solids, typically applied in mechanical or engineering tests, for deformational and strengthening studies.