

Abstract Submitted  
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**Ekman and Taylor Vortices' Destruction and Mixing Enhancement in a Taylor–Couette System With Free Surface** HAMID OUALLI, HICHEM BELKADI, ALI ABDELALI, École Militaire Polytechnique, Algiers, Algeria, AHCENE BOUABDALLAH, Université des Sciences et de la Technologie Houari Boumediene, Algiers, Algeria, MOHAMED GAD-EL-HAK, Virginia Commonwealth University, Richmond, Virginia, USA — Suppression of Ekman and Taylor vortices is desirable in several industrial processes such as cylindrical crystal growth and osmotic/photonic water purification. Inhomogeneities are undesired for the former, and enhanced mixing is sought for the latter. An active flow control strategy is employed to obliterate vortices in a Taylor–Couette flow, and is studied experimentally and numerically. The inner cylinder rotates while the outer one is stationary. The gap between the cylinders is not completely filled with liquid, and thus a free surface is formed below the upper stationary end-cap. The control consists of effecting minute radial pulsatile motion of the inner cylinder cross-section. The superimposed modulations combined with the free surface dynamics suppress both the Ekman and Taylor vortices. Complete destruction of either type of vortices occurs at different pulsatile frequencies, requiring one order of magnitude higher frequency to obliterate the Ekman vortex. When eliminated, fluid particles are no longer trapped within the Ekman or Taylor vortices. This yields significant increase in the axial and azimuthal velocity fluctuations, which results in enhanced flow mixing.

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