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Ekman and Taylor Vortices' Destruction and Mixing Enhancement in a Taylor–Couette System H. OUALLI, M. MEKADEM, A. BENTSABET, M. ABADA, École Militaire Polytechnique, Algiers, Algeria, A. BOUABDALLAH, Université des Sciences et de la Technologie Houari Boumediene, Algiers, Algeria, M. GAD-EL-HAK, Virginia Commonwealth University, Richmond, Virginia, USA — Suppression of Ekman and Taylor vortices is sought in several industrial processes such as cylindrical crystal growth and osmotic/photonic water purification. Last meeting, we investigated experimentally and numerically an active flow control strategy to obliterate vortices in a Taylor–Couette flow. The control consists of effecting minute radial pulsatile motion of the rotating inner cylinder's cross-section. The results showed that destruction of either type of vortices occurs at different pulsatile frequencies, requiring one order of magnitude higher frequency to obliterate the Ekman type. This problem is revisited with identical parameters and conditions for the controlling strategy but the Taylor–Couette system is now inclined relative to the horizontal direction in such a way that gravitational effects are no longer negligible. It is found that body forces contribute to the complete destruction of Taylor and Ekman vortices, reducing the optimum frequency by more than 50% for even a modest inclination angle of $\theta = 15^\circ$. Furthermore, the axial and azimuthal velocity fluctuations are increased by one order of magnitude, thus yielding substantial enhancement in flow mixing.

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