Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Suppressing Taylor vortices in a Taylor–Couette flow system with free surface A. BOUABDALLAH, Université des Sciences et de la Technologie Houari Boumediene, Algiers, Algeria, H. OUALLI, M. MEKADEM, École Militaire Polytechnique, Algiers, Algeria, M. GAD-EL-HAK, Virginia Commonwealth University, Richmond, Virginia, USA — Taylor–Couette flows have been extensively investigated due to their many industrial applications, such as catalytic reactors, electrochemistry, photochemistry, biochemistry, and polymerization. Mass transfer applications include extraction, tangential filtration, crystallization, and dialysis. A 3D study is carried out to simulate a Taylor–Couette flow with a rotating and pulsating inner cylinder. We utilize FLUENT to simulate the incompressible flow with a free surface. The study reveals that flow structuring is initiated with the development of an Ekman vortex at low Taylor number, Ta = 0.01. For all encountered flow regimes, the Taylor vortices are systematically inhibited by the pulsatile motion of the inner cylinder. A spectral analysis shows that this pulsatile motion causes a rapid decay of the free surface oscillations, from a periodic wavy movement to a chaotic one, then to a fully turbulent motion. This degenerative free surface behavior is interpreted as the underlying mechanism responsible for the inhibition of the Taylor vortices.

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Date submitted: 15 Jul 2016 Electronic form version 1.4