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Genesis of Taylor–Couette Flow Instabilities H. OUALLI, M. MEKADEM, M. KHIRENNAS, Y. REZGA, S. TEBTAB, T. AZZAM, Ecole Militaire Polytechnique, Algiers, Algeria, A. BOUABDALLAH, Universite des Sciences et de la Technologie Houari Boumediene, Algiers, Algeria, M. GAD-EL-HAK, Virginia Commonwealth University, Richmond, Virginia, USA — Numerical simulations are conducted of a Taylor–Couette flow from early structuring stages to completion of the Taylors axial stationary waves. We seek to elucidate the underlying mechanisms responsible for the genesis of this flow type and to identify the intermediate embryonic stages up to the birth and completion of the Taylors axial stationary vortices. A 3D numerical simulations of liquid benzene are implemented on FLUENT. The calculations are based on the finite-volume method with a mesh size of 32×28×256 in, respectively, the radial, azimuthal, and axial directions. The simulations are validated using prior experimental results. The calculations span Taylor numbers from $Ta = 10^9$ to $Ta = 43.8$. The results show that the incipient pressure variations are of the order of 10^{12} Pa, detected at $Ta = 10^9$, on four symmetrically separated cardinal points within the system. When $Ta > 10^9$, a progressive propagation of alternating overpressure and depression zones operate in both azimuthal directions. This is the first step in the chain of mechanisms responsible for the Taylors wave building process. The study reports, for the first time, all the details to explain the instability mechanisms evolution.

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