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Instabilities in the oscillatory flow of a complex fluid JORDI ORTIN, MIREIA TORRALBA, Dept. ECM, Universitat de Barcelona, Spain, ALFONSO A. CASTREJON-PITA, GABRIELA HERNANDEZ, GUADALUPE HUELSZ, JOSE ANTONIO DEL RIO, Centro de Investigacion en Energia, UNAM, Mexico — The dynamics of both a Newtonian and a viscoelastic shear- thinning fluid, subjected to an oscillatory pressure gradient in a vertical tube, is studied experimentally. PIV is used to determine the 2d velocity fields in the vertical plane of the tube axis, for driving amplitudes from 0.8 to 2.5 mm and driving frequencies from 2.0 to 11.5 Hz. The Newtonian fluid exhibits always a laminar flow regime, independent of the axial position. For the complex fluid, instead, the parallel shear flow regime exhibited at low amplitudes [Torralba et al., Phys. Rev. E **72**, 016308 (2005)] becomes unstable at higher drivings against the formation of symmetric vortices, equally spaced along the tube. At even higher drivings the vortex structure itself becomes unstable, and complex nonsymmetric structures develop. The system studied represents an interesting example of the development of shear-induced instabilities in nonlinear complex fluids in purely parallel shear flow.

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