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The transition to aeration in a two-phase turbulent mixing system[1] LYES KAHOUADJI, ASSEN BATCHVAROV, CRISTIAN R. CONSTANTE AMORES, Imperial College London, SEUNGWON SHIN, Hongik University, JALEL CHERGUI, DAMIR JURIC, LIMSI-CNRS, RICHARD V. CRASTER, OMAR K. MATAR, Imperial College London — We consider the mixing of a viscous fluid by the rotation of a pitched blade turbine inside an open fixed cylindrical tank, with a lighter fluid above, as a model of an industrial mixing environment. The complex impeller induces primary vortices, that arise in many idealised rotating flows, and additionally several secondary vortical structures resembling Kelvin-Helmholtz, vortex breakdown, blade tip vortices, and end-wall corner vortices. As the rotation rate increases we eventually reach an extreme situation, aeration, when the fluid-fluid interface reaches the rotating blades and a mixing bubbly rotating flow occurs; the approach to this aerated state is investigated using numerical simulation. We utilise a highly parallelized numerical implementation, taking advantage of a domain decomposition strategy for parallelization of a hybrid front-tracking/level-set method designed for complex interfacial deformation including rupture and coalescence.

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