Abstract Submitted
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Numerical and Experimental study of secondary flows in a rotating two-phase flow: the tea leaf paradox[1] ANTONI CALDERER, St. Anthony Falls Lab., University of Minnesota, DOUGLAS NEAL, RICHARD PREVOST, LaVision Inc., ARNO MAYRHOFER, Institute for Water Management, Hydrology and Hydraulic Engineering, ALAN LAWRENZ, JOHN FOSS, Department of Mechanical Engineering, Michigan State University, FOTIS SOTIROPOULOS, St. Anthony Falls Lab., University of Minnesota — Secondary flows in a rotating flow in a cylinder, resulting in the so called tea leaf paradox, are fundamental for understanding atmospheric pressure systems, developing techniques for separating red blood cells from the plasma, and even separating coagulated trub in the beer brewing process. We seek to gain deeper insights in this phenomenon by integrating numerical simulations and experiments. We employ the Curvilinear Immersed boundary method (CURVIB) of Calderer et al. (J. Comp. Physics 2014), which is a two-phase flow solver based on the level set method, to simulate rotating free-surface flow in a cylinder partially filled with water as in the tea leave paradox flow. We first demonstrate the validity of the numerical model by simulating a cylinder with a rotating base filled with a single fluid, obtaining results in excellent agreement with available experimental data. Then, we present results for the cylinder case with free surface, investigate the complex formation of secondary flow patterns, and show comparisons with new experimental data for this flow obtained by Lavision.

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