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A study of thin-walled Taylor column under the influence of rotation[1] KUAN-RUEI LAI, CHIN-CHOU CHU, CHIEN-CHENG CHANG, Institute of Applied Mechanics, National Taiwan University — An extended study of thin-walled Taylor column under the influence of rotating cylinder is presented with very consistent results in numerical simulations and laboratory experiments. In the previous set-up, the Taylor column effect is produced under the influence of protruded cylinder from the top lid, and the thin-walled Taylor column is formed by draining of the fluid at the bottom. The primary interest of this study is to investigate the influence to thin-walled Taylor column when the cylinder is exerted with a relative rotation rate under very small Rossby number ($Ro= U/fR$) and Ekman number ($Ek= \nu/fR^2$). The flow patterns are performed with different cylinder height ratios (h/H) along with varying relative rotation ratio of cylinder to the background $\alpha = \omega/\Omega$. Steady-state solutions being solved numerically in the rotating frame are shown to have good agreements with experimental flow visualizations on the resulting appearance of deformed thin-walled Taylor columns. As a result, the thin-walled Taylor column is observed to strengthen up with increasing α, and weakens with decreasing α. In addition, the weakening thin-walled Taylor column is observed to experience a break through transition near the bottom, which penetration diverged the recirculating region into two portions.

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