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Swirling flow in presence of a moving free surface ROLAND BOUFFANAIS, Massachusetts Institute of Technology, DAVID LO JACONO, Monash University — The incompressible swirling flow of a viscous fluid enclosed in a cylindrical container with a freely-moving top surface and driven by the steady rotation of the bottom wall is studied both experimentally and numerically. This work is aimed at increasing our understanding of the influence of the presence of a moving free surface on this swirling flow dynamics. New flow states corresponding to a Reynolds number of $6'000$ are investigated based on the fully three-dimensional solution of the Navier–Stokes equations for this free-surface cylindrical swirling flow, without resorting to any symmetry properties unlike all other results available in the literature. The numerical results are thoroughly compared to PIV measurements for the exact same configuration. To our knowledge, this study delivers the most general available results for this moving free-surface problem due to its original treatment.

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