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Vortex breakdown in simple pipe bends JESSE AULT, SANGWOO SHIN, HOWARD STONE, Princeton University — Pipe bends and elbows are one of the most common fluid mechanics elements that exists. However, despite their ubiquity and the extensive amount of research related to these common, simple geometries, unexpected complexities still remain. We show that for a range of geometries and flow conditions, these simple flows experience unexpected fluid dynamical bifurcations resembling the bubble-type vortex breakdown phenomenon. Specifically, we show with simulations and experiments that recirculation zones develop within the bends under certain conditions. As a consequence, fluid and particles can remain trapped within these structures for unexpectedly-long time scales. We also present simple techniques to mitigate this recirculation effect which can potentially have impact across industries ranging from biomedical and chemical processing to food and health sciences.

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