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Role of helicity in vortex breakdown SAMEEN A, MANJUL SHARMA, Dept. of Aerospace Engg., Indian Institute of Technology Madras, Chennai 600036, India — We investigate the bubble-type vortex breakdown flow numerically through a model problem of flow inside a cylinder with top rotating lid (also known as Vogel-Escudier flow). The parameters of the flow are $Re = \omega R^2/\nu$ and aspect ratio $\Gamma = H/R$, depending on which flow exhibits steady or unsteady breakdown bubble topologies. We find that a negative helicity density is generated by the rotating top lid and is injected in the bulk of the flow at a critical value of the Reynolds number in the event of vortex breakdown. The flow also shows two-dimensional-three-dimensional (2D3C) characteristics for which the helicity density is decomposed into $rz-$component ($h_{r,z}$) and out-of-the-plane component (h_θ). We find that the topology of the breakdown bubble correlates directly to the decomposed helicity $h_{r,z}$. Using only the decomposed helicity, $h_{r,z}$, complete breakdown bubble is reconstructed for non-axisymmetric flows. This correlation indicates that the vortex breakdown is the interplay between the axial component of velocity and the axial component of vorticity which are characterized by $h_{r,z}$.

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