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Interaction of a Vortex Ring with Surfaces of Constant Porosity[1]

JOHN HRYNUK, DOUG BOHL, Clarkson University — The interaction of vortices with surfaces is a fundamental process in many natural and technological flow fields. In this work we study the interaction of a vortex ring with porous surfaces using Laser Induced Fluorescence. The surfaces studied were stainless steel screens with a constant open area of 65% but different wire diameters (0.017-0.267 cm). Three distinct interactions were observed: 1) For small wire diameters the vortex rings passed through the screens and maintained their coherence and size but with a much slower convection speed. Secondary rings were formed on the upstream side of the screen and convected back upstream; 2) For medium gage wires the vortex ring broke up as it passed through the screen but reformed into a coherent vortex later downstream; 3) For large gage screens the vortices broke up and did not reform downstream. The transition between the interaction types appeared to be dependent on shedding from the screen wires. Specifically, for the small gage screens no shedding from the screen was observed. The medium gage wire showed the beginning of vortex shedding off of the screen wires while the large gage wires showed clearly formed vortices being shed from the screen wires.

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