

Abstract Submitted  
for the DFD16 Meeting of  
The American Physical Society

**Numerical study of asymmetrical modes in a vortex ring impacting a conical surface**<sup>1</sup> JOSE ANTONIO TREJO GUTIERREZ, ERICK JAVIER LOPEZ SANCHEZ, SERGIO HERNANDEZ ZAPATA, GERARDO RUIZ CHAVARRIA, Facultad de Ciencias, Universidad Nacional Autonoma de Mexico — In this work we investigate the impact of an annular vortex on a conical surface when their symmetry axes are parallel but they do not coincide. For this purpose we solve the Navier-Stokes and continuity equations in cylindrical coordinates. We use a finite difference scheme for  $r$  and  $z$  coordinates whereas for the angular coordinate we use a Fourier spectral method. We study the development of asymmetrical modes when the vortex approaches the inner surface of the cone. The presence of the vortex ring induces the formation of a boundary layer which detaches and leads to the formation of a secondary vortex of opposite sign which moves away the cone. This secondary vortex also exhibits asymmetrical modes, which are attenuated as it moves. We present some results as the trajectories of the primary and the secondary vortices, their circulations as a function of time, the development of asymmetrical modes and the dependence of these properties on the Reynolds number and the distance between both symmetry axes. Finally we made a comparison of primary and secondary vortices with a free vortex.

<sup>1</sup>Authors acknowledge DGAPA-UNAM by support under project IN115315 Ondas y estructuras coherentes en dinamica de fluidos.

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Date submitted: 01 Aug 2016

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