Influence of the multipole order of the source on the decay of an inertial wave beam in a rotating fluid

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Abstract

We analyze theoretically and experimentally the far-field viscous decay of a two-dimensional inertial wave beam emitted by a harmonic line source in a rotating fluid. By identifying the relevant conserved quantities along the wave beam, we show how the beam structure and decay exponent are governed by the multipole order of the source. Two wavemakers are considered experimentally, a pulsating and an oscillating cylinder, aiming to produce a monopole and a dipole source, respectively. The relevant conserved quantity which discriminates between these two sources is the instantaneous flow-rate along the wave beam, which is non-zero for the monopole and zero for the dipole. For each source the beam structure and decay exponent, measured using particle image velocimetry, are in good agreement with the predictions.

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