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Librational forcing of a rapidly rotating fluid-filled cube KE WU, JUAN M LOPEZ, BRUNO W WELFERT, Arizona State University — The dynamics of the fluid flow in a rapidly rotating cube excited via libration are explored numerically by solving the full 3D incompressible Navier-Stokes equations via a Chebyshev pseudospectral (collocation) code. The code is first validated against experimental results available in the literature, with rotational Reynolds number of order 10^4 and relative libration amplitudes of order 0.02. In particular, we confirm resonance at certain libration frequencies corresponding to intrinsic (Kelvin) modes of the cube. These Kelvin modes are obtained by solving the Euler equations linearized about the solid-body rotation state. We also verify the existence of waves beams emerging from both the top and bottom edges of the cube and propagating obliquely upward and downward when the ratio of libration frequency to background rotation frequency is less than 2. We then explore the weakly nonlinear nealy inviscid regime by increasing the rotational Reynolds number up to 10^7 and reducing the relative libration amplitude to 10^{-7}.

Ke Wu
Arizona State University

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