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INERTIAL WAVES AND VIBRATIONAL THERMAL CONVECTION

Abstract

Thermal convection excited by inertial waves is experimentally studied inside a rotating cavity filled with a non-isothermal fluid. The inertial waves are generated by fluid oscillations relative to the cavity. The fluid oscillations appear as a result of cavity vibrations or its rotation about an axis inclined in an external force field (tidal oscillations). The experiments are carried out with cavities of different geometries, as follows. A plane layer with boundaries at different temperature and cylindrical adiabatic sidewall, rotating about an axis perpendicular to the layer, and a horizontal rotating cylinder with internal heat sources and isothermal sidewall are considered.

It is revealed that the interaction between inertial waves and inhomogeneous non-isothermal temperature field induces averaged convective flows. The waves, experiencing multiple reflections on the cavity boundaries, generate the flows of non-isothermal liquid organized into a periodic system of azimuthal vortices alternating in sign. Inside the cylindrical cavity the flow structure is determined by the interaction of waves propagating in the opposite directions and depends on the relative cavity length.

It is shown that the thermovibrational convection, induced by the action of inertial waves propagating in a non-isothermal liquid, develops in a non-threshold manner and differs from the known ("classical") vibrational convection studied earlier in [1, 2].

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Bibliography

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