RESEARCH RAYLEIGH-BENARD CONVECTION OF LIQUIDS BY METHODS AUTOCOLLIMATION HILBERT-OPTICS AND THERMOVISION

V.A. ARBUZOV[1,2], N.C. BUFETOV[1], Yu.N. DUBNISHCHEV[1,2,c], E.O. SHLAPAKOVA[2]

[1] Institute of Thermophysics of the SB RAS, Novosibirsk, 630090, Russia
[2] Department of Applied-Physics, Novosibirsk State Technical University, Novosibirsk, 630092, Russia

[c] Corresponding author: Tel.: +375172841353; Fax: +73833307881; Email: dubnistchev@itp.nsc.ru

KEYWORDS:

    Main subjects: heat and mass transfer, flow visualization
    Fluid: vortical structures in air, free-convective jets in a liquid
    Visualization method(s): Hilbert-optics, thermovision
    Other keywords: image processing

ABSTRACT: Rayleigh-Benard convection (RBC) of a liquid in layers with rigid bottom and top free borders in stationary and non-stationary temperature fields is investigated . The unique experimental complex allowing to study evolution of RBC-structures of a free surface of the heavy liquid by methods autocollimation Hilbert-optics and thermovision is created. Evolution of RBC-structures depending on « the operating parameter » (a gradient of temperatures in a layer of a liquid) was experimentally researched under various initial and boundary conditions. Similarity of the RBC-structures visualized in optical and thermal spectral areas of radiation is find out. Profiles of the surface and temperature distribution in the allocated sections of Rayleigh-Benard structures are received and their mutual conformity is shown.
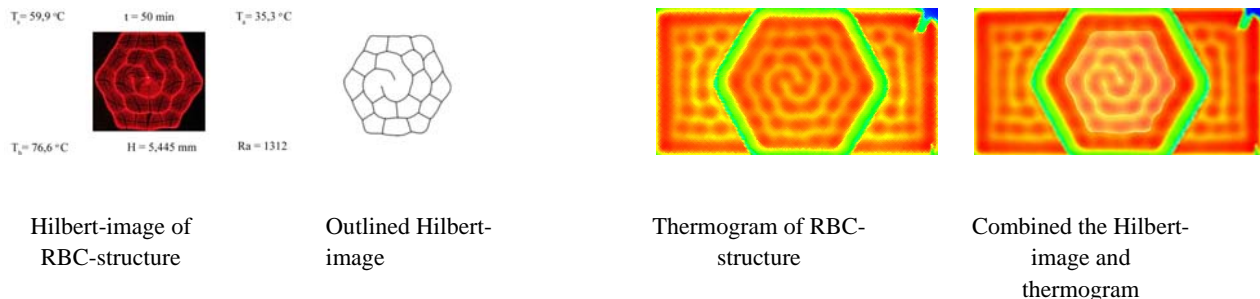
    Hilbert-image of   Outlined Hilbert-   Thermogram of RBC-   Combined the Hilbert-
    RBC-structure   image   structure   image and
                                                                     thermogram

Fig. 1 Flow visualization of the RBC structure at hexagonal geometrical boundary conditions

References

1. Dubnishchev Yu.N. *Theory and transformation signals in optical systems.* Lan, St.-Petersburg, 2011
2. Arbuzov V.A., Dubnishchev Yu.N. *Methods of Hilbert-optics in measuring technologies.* NSTU, Novosibirsk, 2011