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Family of fine fluid flow components: theory and laboratory observations

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A new classification of flow components based on complete solutions of the fundamental set of governing equations including equation of state, Navier-Stokes, Fourier and/or Fick equations is developed. Solutions of linearized form of the set are constructed by theory singular perturbations methods. Complete set of solutions includes regular disturbed type functions, which are damped due to impact of dissipative factors and a more rich family of singular disturbed functions. They constitute family of fine structures on solid surfaces and their analogues in the fluid interior which can be stationary (soaring interfaces inside attached waves past uniformly moving obstacles) or twinkle type. Transverse length scales for singular disturbed solutions are proportional to kinetic coefficients. Effects of compressibility, general rotations and stratification are taking into account if general classification. 3D analogues of oscillating plane Stokes problem are investigated. In stratified fluid solution describes periodic internal waves produced by an oscillating domain as well as their envelopes are investigated in details. Energy is transported inside the sloping wave beams. The energy dissipation and vorticity are associated with twinkle fine components. Schlieren observations of disturbances produced by oscillating strip, piston, disc and sphere are compared with calculations. Formation of vortices in domains of singular components convergence inside the fluid body was observed. Extrapolation on the environment is discussed.