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Mathematical classification of real fluid flow components

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Proposed classification flow components is based on general properties of the fundamental set of governing equations including equation of state, Navier-Stokes, Fourier and/or Fick equations. Dynamical status of undisturbed continuously stratified on salinity fluid is formed by transient diffusion induced flows and includes narrow boundary flows, extended vortices and dissipative gravity waves. General analysis of linearized part of the singular disturbed set of governing equations is performed by a multiscale perturbation method. Complete set of solutions includes regular disturbed type functions, which are proportional to dissipative factors and a more rich family of singular disturbed functions. Transverse length scales for singular disturbed solutions are proportional to kinetic coefficients. They constitute family of superimposed periodic boundary layers 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. Periodic internal waves produced by an oscillating piston are investigated in details. Energy is transported inside the sloping wave beams. The energy dissipation and vorticity are associated with twinkle components. Passive admixture is accumulated on singular disturbed components. Numerical visualization of constructed complete solutions reveals high gradient envelopes of wave beams. In slightly non-linear approximation all flow components interact with each other directly. Non-linear interaction is the most effective in domains of the envelopes convergence, where vortices can be formed directly inside the fluid body. Formation of vortices in these domains in a continuously stratified fluid was observed in experiments with forced oscillating discs, spheres or free oscillating neutral buoyancy bodies. Experiments reveal too strong anisotropic transport of dye from compact spot inside compound vortex and formation of spiral arms on the surface of rotating fluid. Extrapolation on the environment is discussed.