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Regular and singular disturbed components of periodic stratified flows: dynamics of waves and fine structures

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A new classification of solutions for linearized set of fundamental governing equations including empiric equation of state, Navier-Stokes, Fourier and/or Fick differential equations and its reduced/degenerated forms (including conventional D'Alembert- Euler and D'Alembert-Navier-Stokes systems for homogeneous fluids) is presented. The sets are treated as high order coupled systems of equations having regular disturbed and rich family singular disturbed solutions. The advantage of the approach is construction of solutions satisfying to physically substantiated boundary conditions that are no-slip for velocity and no-flux for stratified component and density exactly. Due to a high order of the set the solutions are constructed analytically and analyzed asymptotically or numerically. As example periodic flows generated by periodically oscillating strip or disc are analyzed. Both types of solutions are constructed and analyzed in linear and slightly non-linear approximations when components interact between themselves directly. In domains of singular disturbed solution convergence vorticity is accumulated. Calculations are compared with precise laboratory experiments. Flow patterns including diffusion induced boundary flows on obstacles, internal wave beams, interfaces and vortices are visualized. Formation of isolated vortices inside crossed wave beams inside the fluid was observed. Extrapolation of theoretical results and laboratory data on the environmental conditions is discussed.