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Comparison of Infinitesimal Symmetries of Different Theoretical Models of Environmental Flows

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Due to the complexity of fundamental set of the governing equations set in practical applications they are substituted by more specified non-linear models like different theories of turbulence boundary layers and different kind of waves. Progress in computer hard and soft techniques gives a room for practical realization advanced mathematical algorithms for analytical estimations of degree of correspondence between different models. Here we are presenting results of application of Lie groups theory to calculations of continuous symmetries widely used geophysical fluid dynamics models. Calculated symmetries of fundamental Mendeleev-D'Alembert-Navier-Stokes-Fourier-Fick correspond to basic laws of conservations. Symmetry group of can be expanded or reduced by selection on the functional form of the equations algebraic parts that are equations of density state for and empirical functions for viscosity and diffusivity coefficients. Widely used Boussinesq approximation leads to expansion of the basic symmetry groups. In boundary layer theory equations some rotational symmetry gets lost. To improve description of fluid dynamics sophisticated models of turbulence with different closure schemes are developed. Some of the sets does not contain operator of Galilean transformation, which is fundamental in classical mechanics and contain additional generators which does not follows from physical properties of fluid. In small dissipation factors limit the basic set is treated by methods of high order singular perturbation theory. Both kinds of solutions that are regular and singular perturbed functions are to be used to construct complete solutions of the fundamental set with 'no-slip' and 'no-flux' boundary conditions.