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General solutions of the unsteady Navier-Stokes equations in one, two and three dimensions VICTOR A. MIROSHNIKOV — General solutions of the unsteady Navier-Stokes equations in 1D, 2D, and 3D are derived symbolically as the Boussinesq-Rayleigh series in a coordinate and continued numerically by parallel computing. The main results of this presentation are sorted in three groups. First, several exact theorems are proved for the Navier-Stokes equations and the Stokes equations since the differential and tensor recurrent relations may be written in the closed form. For instance, it is shown that flows away from boundaries may be decomposed into the following basic flows: the Couette flow, the Poiseuille flow, the Bernoulli flow and the Stokes flow. Second, symbolic existence theorems are obtained since computation, validation, and convergence of the free and forced general solutions of the Navier-Stokes equations is treated symbolically. Third, new numerical algorithms of evaluation, continuation, and visualization of multi-scale flow structures are developed. In 3D, the flow structures are visualized by stream surfaces and stream tubes formed by streamlines with constant integration times, which continue two-dimensional isocurves of the streamfunction.

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