Landau — Lifshits vibrator in the equations of gas dynamics

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The problem of explaining the causes of turbulence excited L.D. Landau back in the 1940s. Much later, after the presentation of the famous method of the acoustic analogy of M.J. Lighthill, in the textbook "Hydrodynamics" by L.D. Landau and E.M. Lifshits (1988) members responsible for the formation of periodic waves against a background of steady laminar flow appeared in a complete nonstationary system of equations of gas dynamics. They were the convective terms of the equation of motion. Convective terms, as the source of the oscillations appearance, attracted attention of A.S. Predvoditelev, who introduced the coefficient 1-β to the equation of motion to describe turbulence. In the article it became possible to represent the inhomogeneous terms of the wave equation arising from the convective terms, through second-order Jacobians of the velocity vector, previously given by Euler in the equation of continuity. The inhomogeneous part of the wave equation for the velocity vector having derived by L.D. Landau and E.M. Lifshits, transformed to the sum of second-order Jacobians, makes it possible to specify the velocity fields of the hydrodynamic flows calculated earlier, to obtain an estimate of the generation intensity of periodic waves produced by a stationary flow. L.D. Landau and E.M. Lifshitz established that when using the M.J. Lighthill method of acoustic analogy the convective terms of the gas dynamics equation of motion penetrate into the inhomogeneous part of the wave equation, which corresponds to the generation of sound and self-oscillations not associated with external influences on the flow. The wave equation which they derived from the system of gas dynamics equations without involving extraneous relations can have the same solution as the indicated system of equations. This inhomogeneous wave equation can be regarded as a vibrator building-up both its analytical solution and the solution of problems of gas flow around bodies by numerical methods.

Keywords: *convective terms of the equation of motion, self-excited oscillations, inhomogeneous wave equation, acoustic analogy method*

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