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Sub- and Supersonic Shapes without Separation and Cavitation

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The slender body theory was applied to calculate axisymmetric bodies with the given pressure distribution on the surface and to investigate the principal problem of hydrodynamics: can the pressure gradient be positive on the body surface to ensure an unseparated flow pattern and to improve cavitation inception characteristics? Methods of calculating of axisymmetric and plane shapes in ideal compressible fluid, based on the potentials of sources and doublets located on the axis of symmetry are proposed. Analytic formulae for streamline functions and calculations results for different Mach numbers are presented. The obtained shapes with specific pressure distribution ensure the flow without boundary-layer separation and without cavitation inception for bodies moving in water at high velocities. The axisymmetric supersonic form of minimal pressure drag was obtained. Results of experimental investigations of axisymmetric shapes without separation are rewiewed. Some of such forms ensure unseparated flow pattern at relative small Reynolds numbers. Since the origin of cavitation on a smooth shape is connected with separation, presented bodies could ensure the flow of liqiud without cavitation.

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