GENERAL THEORY OF AXISYMMETRIC CONIC AND LOCALLY CONIC FLOWS AND REFLECTION OF STATIONARY SHOCK WAVES FROM THE AXIS OF SYMMETRY

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Abstract

There are investigated axisymmetric conic and locally conic flows of not viscous and not heat-conducting gas. In polar coordinates with the center of conicity in an axis of symmetry the parameters of conic flows (CF) are the functions of only polar angle φ in infinite or finite parts of a physical plane. For locally conic flows (LCF) this property is strictly executed in the center of conicity and approximately - near to it. A necessary condition of local conicity is the distinction from zero of radial components of velocity in the center of conicity at least in one of the ray φ = const. The researched flows are conically sub- or supersonic. If we do not consider a uniform flow as CF, then the change of the CF type with one exception (the joining of two different types of CF along the C^+-characteristic) is possible only over the shock wave (SW). The flow lines and the $C^{\pm}$-characteristics are constructed for LCF, which would arise when flow without deceleration of a sharpness point of a rotation body trailing part and when regular SW reflection from an axis of symmetry, and also for almost all CF, including a number of new those. The consequences of LCF theory are the impossibility of regular SW reflection from an axis of symmetry and inapplicability for the proof of this fact of A.A.Nikolsky's reception with integration of a compatibility condition along the C^--characteristic, which would come to a point of regular reflection. For initially weak SW by the numerical integration of the Euler equations with using of crushed to an axis numerical grids there are determined the sizes of Mach disks. As functions of initial SW intensity they decrease faster, than under the square-law.

Key words: the flow lines and the $C^{\pm}$-characteristics of conically sub- and supersonic axisymmetric conic and locally conic flows, the necessary condition of local conicity, the change of the conic flows type, new conic flows, the impossibility of regular shock waves reflection from an axis of symmetry, the dependence of the Mach disk size from the intensity of initially weak shock waves.