Selected Abstracts from Soviet Aerospace Literature

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Please direct questions concerning this abstract section of the *AIAA Journal* to John Newbauer, AIAA Administrator, Technical Publications.

A86-29950 Numerical methods in singular integral equations and their use in aerodynamics, elasticity theory, and electrodynamics (Russian book) (Chislennye metody v singuliarnykh integral'nykh uravneniiakh i ikh primenenie v aerodinamike, teorii uprugosti, elektrodinamike). S. M. BELOTSERKOVSKII and I. K. LIFANOV, *Moscow, Izdatel'stvo Nauka,* 1985, 256 pp. 124 refs.

The mathematics and numerical methods of solution of singular integral equations with one-dimensional and multiple Cauchy integrals are presented. In particular, attention is given to quadrature formulas for one-dimensional and multidimensional singular integrals and multiple Cauchy integrals; direct methods for solving singular integral equations based on the quadrature formulas; and the method of discrete vortexes for solving a wide range of linear stationary problems in aerodynamics. The discussion also covers applications of the numerical methods in elasticity theory, electrodynamics, mathematical physics, and any field where problems can be reduced to the solution of singular integral equations.

A86-23615 Problem of vortex removal through the porous boundary of a computational domain of an unsteady subsonic flow (O probleme vyvoda vikhrei cherez pronitsaemuiu granitsu raschetnoi oblasti nestatsionarnogo dozvukovogo potoka). A. T. FEDORCHENKO, *Zhurnal Vychislitel'noi Matematiki i Matematicheskoi Fiziki* (ISSN 0044-4669), Vol. 26, Jan. 1986, pp. 114-129. 11 refs.

Boundary conditions are formulated for a case in which a series of intense vortices is carried by a subsonic flow through the porous boundary of a computational domain. It is shown that a formal use of traditional local boundary conditions can express the nonphysical effects of the conversion of vortex perturbations into acoustic ones at the section of the boundary considered. Methods for the removal of the vortices from the computational domain are proposed with the aim of eliminating these nonphysical effects. These methods involve the specification of nonlocal boundary conditions of a special form or the application of a controlling action on the flow at the boundary.

A86-32735 Distribution of radiant heat fluxes over the surface of three-dimensional and axisymmetric bodies in supersonic flow of an ideal gas (O raspredelenii luchistykh teplovykh potokov po poverkhnosti prostranstvennykh i osesimmetrichnykh tel pri sverkhzvukovom obtekanii ikh ideal'nym gazom). E. Z. APSHTEIN, N. V. VARTANIAN, and V. I. SAKHAROV, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Jan.-Feb. 1986, pp. 92-97. 13 refs.

Three-dimensional supersonic flow of a nonviscous heat-conducting gas in a compressed shock layer past a blunt body is investigated analytically with allowance for radiation energy transfer and equilibrium chemical reactions. A system of unsteady equations of radiation gas dynamics is written in divergent form and solved using a second-order MacCormack finite-difference scheme. Calculation results are reported for a wide range of axisymmetric and three-dimensional bodies ranging in size from 0.01 to 20 m, the velocity and height ranges being 1 -18 km/s and 40-80 km, respectively. A simplified method for determining radiant flows toward the front part of three-dimensional bodies is proposed.

A86-24287 Nonlinear integro-differential aeroelasticity equations (Nelineinye integrodifferentsial'nye uravneniia aerouprugosti). I. S. ASTAPOV, A. S. BELOTSERKOVSKII, and V. I. MOROZOV, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Tverdogo Tela* (ISSN 0572-3299), Nov.-Dec. 1985, pp. 61-70. 7 refs.

Nonlinear integro-differential nonstationary aeroelasticity equations are obtained for the general case of the three-dimensional motion of an elastic flight vehicle with loads in a nonstationary gas flow. Cauchy formulas for the Volterra integro-differential equations, unresolved with respect to the derivative, are presented. The formulas presented here are used for analyzing the stability, in the sense of Liapunov, of solutions to the integro-differential nonstationary aeroelasticity equations in the case where the integral kernels are replaced by approximation functions, with allowance made for the nonlinearity and motion parameters that are explicitly time-dependent.

A86-31418 An analytical study of nonlinear oscillations during uncontrolled descent in the atmosphere (Analiticheskoe issledovanie nelineinykh kolebanii pri neupravliaemom spuske v atmosfere). O. A. PRIVARNIKOV, *Samoletostroenie—Tekhnika Vozdushnogo Flota* (ISSN 0581-4634), No. 51, 1984, pp. 74-79.

Reference is made to an earlier study (Privarnikov 1980) in which expressions have been obtained for the analysis of plane nonlinear oscillations during uncontrolled ballistic descent in the atmosphere. Here, a more accurate solution to the ballistic descent problem is obtained which allows for the nonlinearity of the aerodynamic coefficients and for the effect of oscillations on the motion of the center of mass. The accuracy of the solution is estimated for different degrees of nonlinearity of the aerodynamic coefficients.

A86-25423 Optimal lifting surfaces of wings of complex configurations at supersonic flight velocities (Optimal'nye nesushchie poverkhnosti kryl'ev slozhnoi geometrii pri sverkhzvukovykh skorostiakh poleta). E. M. PROKHOROV, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Nov.-Dec. 1985, pp. 154-160. 12 refs.

The problem of flow past infinitely thin wings, producing only slight perturbations in an ideal gas, is analyzed using a linear formulation. The optimum shape of the wing is determined by finding a function of the local angles of attack which corresponds to a minimum drag coefficient under constraints on the lifting force coefficient and the pitching moment. For a given Mach number, nonseparated flow is realized on an optimal wing, with a zero load on the subsonic leading edge.

A86-25599 Aerodynamics of lifting surfaces in steady flow (Russian Book) (Aerodinamika nesushchikh poverkhnostei v ustanovivshemsia potoke). N. F. VOROBEV, *Novosibirsk, Izdatel'stvo Nauka,* 1985, 240 pp. 91 refs.

Problems concerning subsonic and supersonic flow past surfaces are reduced to solving integral equations, and examples of exact solutions are presented. Green functions are determined for the wave equation for prismatic regions, which makes it possible to obtain solutions to problems of supersonic flow past complex configurations with allowance for reflection and diffraction phenomena. Approximations of solutions to integral equations are discussed; the convergence behavior of the discrete vortex method is analyzed.

A86-32734 The far nonlinear field of a nonlifting profile for a generalized equation of transonic flow (Dal'nee nelineinoe pole nenesushchego profiliia dlia obobshchennogo uravneniia transzvukovogo techeniia). G. D. SEVOSTIANOV and O. P. SINICHKINA, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Jan.-Feb. 1986, pp. 87-91. 8 refs.

The transonic flow equation for dimensional steady nonvortex flows of an ideal gas obtained in an earlier study (Sevostianov, 1977) is extended to the case of subsonic, transonic, or supersonic flows in the near-constant velocity region using orthogonal flow coordinates. The knowledge of the nonlinear field in difference analysis of transonic flow past profiles makes it possible to reduce the size of the near field in comparison with the region defined by the far field in linear theory.

A86-35082 Fatigue life in a coupled problem concerning the motion of a flexible wing (Ustalostnaia dolgovechnost' v sviazannoi zadache o dvizhenii gibkogo kryla). B. A. ERSHOV, *Leningradskii Universitet, Vestnik, Matematika, Mekhanika, Astronomiia* (ISSN 0024-0850), Jan. 1986, pp. 122-123. 5 refs.

A method is presented for calculating the fatigue life of a flexible wing moving at a supersonic velocity in a turbulent atmosphere. In accordance with the method proposed here, the fatigue life is calculated using a formula in which the following parameters must be known: the Wohler curve parameters determined experimentally, parameters of an atmospheric turbulence model, parameters characterizing the random vibrations of the flexible wing, and flow parameters in a formula for the spectral density of wing vibrations.

A86-35978 The optimal take-off run of an aircraft on an unpaved surface (Optimal'nyi razbeg samoleta po gruntu). A. A. BADIAGIN, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 4, 1985, pp. 12-16.

The problem of optimizing the take-off run of an aircraft is investigated analytically. It is shown that the most favorable lift coefficient of a wing during the take-off run depends on the rolling resistance coefficient of the wheels. It is further shown that for a soft unpaved surface there exists an optimal-in-the-limit take-off run with fixed and relatively large angles of attack.

A86-32736 Using the method of aerodynamic equivalency for the determination and analysis of the aerodynamic coefficients of asymmetric bodies (Primenenie metoda aerodinamicheskoi ekvivalentnosti pri opredelenii i analize aerodinamicheskikh koeffitsientov asimmetrichnykh tel). G. G. SKIBA and A. N. TSARKOV, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Jan.-Feb. 1986, pp. 98-105. 8 refs.

A nonlinear version of the aerodynamic equivalency method developed by Skiba and Fedotov (1977) is presented. The method is based on the principle of equivalency of two bodies one of which has an arbitrary cross-sectional shape, while the other has a cross-section described by a smooth function. The function represents a sum of N + 1 first terms of the Fourier series of the initial (discontinuous) function describing the shape of the body. The efficiency of the method proposed here is demonstrated for several star-shaped bodies.

A86-23948 Aerodynamics of swept wings with medium and small aspect ratios. II (Aerodinamika strelovidnykh kryl'ev srednikh i malykh udlinenii. II). V. V. STRUMINSKII, *Moscow, AN SSSR, Sektor Mekhaniki Neodnorodnykh Sred,* 1983, 63 pp.

Test results for sweptback (35, 45, and 60 deg) and sweptforward (−30 deg) wings with various aspect ratios are reported, and the characteristic features of flow past these wings are examined. In particular, an analysis is made of the effect of the sweep angle on the aerodynamic characteristics of aircraft over the full range of angles of attack. Solutions are obtained which make it possible to take advantage of the effect of slip in the wing cross-sections and improve the performance characteristics of swept wings.

A86-28320 Characteristics of the effect of the powerplant jet streams on the design of VTOL aircraft (Osobennosti vozdeistviia reaktivnykh potokov silovykh ustanovok na konstruktsiiu samoleta vertikal'nogo vzleta i posadki). V. V. NOVITSKII and V. F. PAVLENKO, In: Problems in aircraft reliability (A86-28303 12-38) *Moscow, Izdatel'stvo Mashinostroenie,* 1985, pp. 245-252. 17 refs.

The effect of the jet streams from the powerplants and of the turbulent vortexes formed as a result of separated flow past the aircraft nose and superstructure on the design of VTOL aircraft is analyzed using the formalism of random functions. Expressions are obtained for calculating the life of structural elements with allowance for the effect of jets and turbulent vortexes.

A86-43421 Features of the flow structure around polygonal lifting bodies at supersonic velocities (Osobennosti struktury obtekaniia poligonal'nykh nesushchikh korpusov pri sverkhzvukovykh skorostiakh). I. I. MAZHUL (AN SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR), *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskie Nauki* (ISSN 0002-3434), March 1986, pp. 50-54.

The flow characteristics around polygonal lifting bodies consisting of a combination of plane elements were studied experimentally at Mach numbers of 2, 3, and 4, and Reynolds numbers of 26 x 10 to the 6th, 33.5 x 10 to the 6th, and 50 x 10 to the 6th. It is shown that configurations of this type are characterized by the presence of internal shocks and boundary layer separation zones (induced by these shocks) on the lower surface. Another feature is the formation of conical vortex zones along swept lines of plane-face intersection on both upper and lower surfaces. The behavior of these features is studied in relation to the flow conditions.

A86-39658 Propagation of perturbations in a boundary layer at the walls of a plane duct (O rasprostranenii vozmushchenii v pogranichnom sloe na stenkakh ploskogo 0kanala). A. I. RUBAN and S. N. TIMOSHIN, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Mar.-Apr. 1986, pp. 74-79. 5 refs.

An analysis is made of the interaction between the boundary layer and the nonviscous part of steady-state laminar flow of an ideal gas in a plane symmetrical duct at large characteristic Reynolds numbers. The interaction region is located at a large distance from the initial section of the duct, and the longitudinal dimension of the interaction region is an order of magnitude larger than the duct width. It is shown that, at supersonic flow velocities, the perturbations generated in the boundary layer are attenuated exponentially upstream of the perturbation source. At subsonic velocities, as in the case of incompressible fluids, the perturbations do not propagate upstream.

A86-43391 Experimental study of balance components of Reynolds shear stresses in the cross section of a retarded turbulent boundary layer (Eksperimental'noe issledovanie sostavliaiushchikh balansa kasatel'nykh Reinol'dsovykh napriazhenii v sechenii zatormozhennogo turbulentnogo pogranichnogo sloia). E. V. SHISHOV, P. S. ROGANOV, S. A. PLATOV, and V. P. ZABOLOTSKII, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 1, 1986, pp. 66-69.

Consideration is given to a strongly retarded, equilibrium turbulent boundary layer. The components of the shear-stress transport equation were measured, including terms containing static-pressure pulsations and their covariations with velocity pulsations. The experimental data are compared with approximations of second-order turbulence models. The data are used to check existing turbulence models based on the Reynolds-shear transport equation.

A86-35991 Analysis of a three-dimensional stationary turbulent boundary layer on the root section of a wing without allowance for compressibility (Raschet trekhmernogo statsionarnogo turbulentnogo pogranichnogo sloia na kornevom otseke kryla bez ucheta szhimaemosti). G. A. SHCHEKIN, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 4, 1985, pp. 72-76. 6 refs.

A procedure is presented for calculating a three-dimensional stationary boundary layer in the laminar, transition, and turbulent flow regions on wings. As an example, calculations are carried out for a three-dimensional stationary boundary layer on the upper surface of the root section of a swept wing. With the exception of the separation region, the results are found to be in good agreement with data in the literature.

A86-35992 Limiting values of the specific parameters of a ramjet engine (O predel'nykh znacheniiakh udel'nykh parametrov PVRD). V. I. BAZHANOV and A. A. STEPCHKOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 4, 1985, pp. 77-78.

The parameters of a ramjet engine using a supersonic diffuser with 2, 3, and 4 shock waves are calculated in the Mach number range 4-8. It is shown that the engine parameters are improved with increasing flight velocity, this effect being particularly pronounced in the range Mach 4-6; only a slight improvement is observed at Mach greater than 6. An increase in the number of shock waves in the diffuser above three does not change the specific thrust or specific fuel consumption by more than 5 percent.

A86-35994 Group studies of equations of the laminar boundary layer on a rotating wing (Gruppovye issledovaniia uravnenii laminarnogo pogranichnogo sloia na vrashchaiushchemsia kryle). M. A. DARAGAN and S. A. DERBENEV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 4, 1985, pp. 81-84.

A group analysis is made of the unsteady laminar boundary layer on a rotating wing, a problem relevant to many aircraft engineering applications. Invariant solutions are obtained which, in certain particular cases, simplify the analysis of the initial system of equations by reducing by one the number of independent variables. The results of the study provide a way to obtain similar invariant solutions in some other cases.

A85-38850 The aerodynamics of the Tu-154B aircraft (Russian book) (Aerodinamika samoleta Tu-154B). T. I. LIGUM, S. IU. SKRIPNICHENKO, and A. V. SHISHMAREV, *Moscow, Izdatel'stov Transport,* 1985, 263 pp.

The aerodynamic aspects of the flight operations of the commercial Tu-154B aircraft with NK-8-2u turbofan engines are examined. The discussion covers the flight performance characteristics, flight conditions, and stability and controllability, including flight at large angles of attack and special flight conditions. Recommendations concerning aircraft operation under unfavorable meterological conditions are given, as are recommendations for reducing noise during the take-off. Ways to reduce fuel consumption during flight operations are discussed.

A86-43385 Theory of the motion of propeller blades for large displacements (Teoriia dvizheniia lopastei nesushchego vinta pri bol'shikh peremeshcheniiakh). V. A. PAVLOV and S. A. MIKHAILOV *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 1, 1986, pp. 39-42.

A method is proposed for deriving the equations of motion of propeller blades in a flow for large displacements. The mathematical model of a blade being deformed by an arbitrary load is constructed on the basis of spatial-straight-line theory. The external-load components are determined from the deformation grid.

A86-43384 Rotational-translational subsonic motion of a finite-span wing in an ideal gas (Vrashchatel'no-postupatel'noe dozvukovoe dvizhenie kryla konechnogo razmakha v ideal'nom gaze). S. V. MINEVICH, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 1, 1986, pp. 34-38. 5 refs.

An algorithm is presented for the computer calculation of the aerodynamic characteristics of a wing of arbitrary shape with an aspect ratio lambda not less than 2 in rotational-translational motion. The effect of gas compressibility is taken into account by a linearized equation. The accuracy of the calculations was checked on the example of wings of elliptical and rectangular planform in purely rotational or purely translational motion. The accuacy of the proposed method is compared with that of the methods of Karafoli (1956, 1960) and Belotserkovskii (1965).

A86-28525 Aerodynamics of aircraft elements (Russian book) (Aerodinamika elementov letatel'nykh apparatov). K. P. PETROV, *Moscow, Izdatel'stvo Mashinostroenie,* 1985, 272 pp. 70 refs.

The aerodynamic characteristics of the principal aircraft components, such as airfoils, wings of finite length, lift-increasing devices, fuselage, and control elements, are examined in a systematic manner for various flight conditions. The discussion is based on the results of recent experimental studies and contains formulas for approximate aerodynamic calculations. Specific topics discussed include pressure distribution on an airfoil; aerodynamic characteristics of swept wings at low angles of attack in the subsonic and transonic ranges; characteristics of flow past bodies of high aspect ratios; and the effect of the cross-sectional shape of a body of high aspect ratio on its principal aerodynamic characteristics. Finally, some problems associated with the interference between individual aircraft components are examined.

A86-35979 Calculation of the dynamic response of a flight vehicle using a discrete-continuous model (Raschet dinamicheskoi reaktsii letatel'nogo apparata na osnove diskretno-kontinual'noi modeli). M. B. VAKHITOV, A. S. SAFONOV, and I. A. KUZNETSOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 4, 1985, pp. 16-20. 7 refs.

A numerical procedure is presented for calculating the dynamic response of a flight vehicle to external perturbations produced by changes in the kinematic parameters of the flight vehicle motion resulting from control actions or gusts. The elastic deformations of the lifting surfaces are determined in the context of a discrete-continuous model; the nonstationary aerodynamic load is determined using the method of discrete vortices. A solution is obtained in time steps, and results of calculations are presented.

A86-33480 Aerodynamics and molecular gas dynamics (Russian book) (Aerodinamika i molekuliarnaia gazovaia dinamika). V. V. STRUMINSKII, *Moscow, Izdatel'stvo Nauka,* 1985, 240 pp. 166 refs.

A series of fundamental problems of practical interest in aerodynamics and molecular gasdynamics are treated using methods of the boundary layer theory and the kinetic theory of gases. Problems examined include the proof of the existence of the slip effect on rectangular wings of infinite aspect ratio and the conditions under which this effect is observed for wings with various degrees of sweep; the effect of acceleration on the structure of a boundary layer, its separation, and drag at low velocities; and the development of a nonlinear stability theory for plane laminar flows of a viscous liquid. Other problems discussed include the development of a more general method for solving Boltzmann equations and the development of a new nonequilibrium kinetic theory of gases.

A86-35985 Calculation of the aerodynamic characteristics of three-dimensional wings of finite span in a potential incompressible flow (Raschet aerodinamicheskikh kharakteristik ob'emnykh kryl'ev konechnogo razmakha, obtekaemykh potentsial'nym neszhimaemym potokom). S. D. ERMOLENKO and E. A. KIAGUZOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 4, 1985, pp. 43-48.

The problem of potential flow past a wing is solved using the discrete vortex method. The principles of the method are reviewed, and formulas are presented for calculating the distributed and integral aerodynamic characteristics. The efficiency of the method is illustrated by examples. The method described here is applicable to wings of both large (including infinite) and small aspect ratios corresponding to nonseparated flow.

A86-21348 The base drag of a rotating axisymmetric body (Donnoe soprotivlenie vrashchaiushchegosia osesimmetrichnogo tela). V. M. KOVALENKO and G. A. KISEL (AN SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR) *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskie Nauki* (ISSN 0002-3434), Oct. 1985, pp. 58-66. 13 refs.

The effect of rotation on the base drag of an ogive-cylinder configuration with a total aspect ratio of 5.3 is investigated experimentally in a low-turbulence subsonic wind tunnel in the Re range 5.7 × 10 to the 5th — 2 × 10 to the 6th. It is shown that the base drag increases significantly during the rotation of the body; the relative increment of the base drag is somewhat reduced with increasing angle of attack. The physical meaning of the effect described here is examined.

A86-24312 A computer simulation of separated flow past profiles with sharp corners (Modelirovanie na EVM otryvnogo obtekaniia profilei s uglovymi tochkami). S. M. BELOTSERKOVSKII, I. K. LIFANOVK, and A. A. MIKHAILOV (Voenno-Vozdushnaia Inzhenernaia Akademiia, Moscow, USSR) *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 285, No. 6, 1985, pp. 1348-1352. 10 refs.

A computer simulation of separated flow past profiles with sharp corners is presented, with the profile and the wake modeled by vortex surfaces. A modification of the discrete vortex method is proposed which makes it possible to directly determine the potential at the points of interest. Computational results are presented for bodies of various shapes, and the mean values of the drag coefficient are determined.

A86-25414 Characteristics of the laminar-turbulent boundary layer transition on a cone (Osobennosti perekhoda laminarnogo pogranichnogo sloia v turbulentnyi na konuse). A. A. MASLOV and S. G. SHEVELKOV, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Nov.-Dec. 1985, pp. 23-27. 10 refs.

The effect of the unit Reynolds number and of the Mach number on the laminar-turbulent boundary layer transition on a sharp circular cone is investigated experimentally. The perturbation spectra in the boundary layer of the cone are determined, and it is shown that the transition point is largely determined by the level of perturbations at the frequencies that are responsible for the transition. Details of the experimental procedure and equipment are presented.

A86-17096 Structure of a supersonic turbulent boundary layer during its interaction with a shock wave (Struktura sverkhzvukovogo turbulentnogo pogranichnogo sloia pri ego vzaimodeistvii so skachkom uplotneniia). M. A. GOLDFELD, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Sept.-Oct. 1985, pp. 75-82. 13 refs.

The interaction of a turbulent boundary layer with a shock was studied in a supersonic wind tunnel in order to clarify questions connected with the increasing fill coefficient of the velocity profiles. Data on the development, structure, and asymptotic behavior of the boundary layer beyond the interaction region are obtained in axisymmetric flow for Mach numbers of 2-4 and flow rotation angles of 10-25 deg, with particular attention given to the occurrence of separated flow. The data confirm the increase in the fill coefficient beyond the shock as well as a significant increase in the surface friction.

A86-23660 Aerodynamic design of an airfoil with allowance for the condition of nonseparated flow (Aerodinamicheskoe proektirovanie profilia s uchetom usloviia bezotryvnosti). Z. KH. NUGMANOV, V. A. OVCHINNIKOV, and V. G. PAVLOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 3, 1985, pp. 47-50. 6 refs.

The paper is concerned with the problem of plotting the contour of an airfoil for a given surface pressure distribution using the theory of potential flow of an incompressible fluid. The airfoil coordinates are determined in the form of a series expansion in Jacobi polynomials whose coefficients are obtained from the flow line equation by the method of successive approximations. The law of pressure recovery beyond the maximum velocity point is expressed in the form of the Stratford analytical function, which ensures nonseparated flow in this region. Results of calculations are presented.

A86-18903 Flow past caret wings with flaps (Obtekanie caret-kryl'ev s zakrylkami). O. N. IVANOV and A. I. SHVETS, *PMTF—Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), Sept.-Oct. 1985, pp. 41-46. 7 refs.

Results of an experimental study of subsonic and supersonic flow past delta wings with an inverted-V cross section equipped with flaps and having a sweep angle of 71 deg are presented for flare angles of 180, 161, and 120 deg and flap angles of 0, 21, and 40 deg. Determinations are made of pressure distribution along the central chord of the wing and on the flaps. Also, the structure of shock waves produced during supersonic flow past a caret wing with flaps, a cone, and a wedge is analyzed.

A86-18904 Determination of the intensity of a free vortex sheet in the context of airfoil theory (Opredelenie intensivnosti svobodnoi vikhrevoi peleny v ramkakh teorii nesushchei poverkhnosti). N. F. VOROBEV, *PMTF—Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), Sept.-Oct. 1985, pp. 46-50. 7 refs.

For a lifting surface in subsonic incompressible potential flow, the conditions determining the intensity of a free vortex sheet produced by the leading (side) edge are determined on the basis of the vortex line conservation law. In the case of the discrete vortex scheme of a slender wing of finite span considered here, the dependence of the vortex sheet intensity on the angle of sweep is obtained in explicit form. For slender rectangular and triangular plates, the results of calculations of integral aerodynamic characteristic are compared with experimental data.

A86-18907 Heat transfer at the lateral surface of a blunt cone during the absorption of the entropy layer by a laminar or a turbulent boundary layer (Teploobmen na bokovoi poverkhnosti zatuplennogo konusa pri pogloshchenii entropiinogo sloia laminarnym i turbulentnym pogranichnym sloem). IU. N. ERMAK, N. P. KOLINA, and A. IA. IUSHIN, *PMTF—Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), Sept.-Oct. 1985, pp. 65-69. 8 refs.

The effect of entropy layer absorption on the aerodynamic heating of a blunt round cone with a half-angle of taper of 10 deg is investigated experimentally and analytically for Mach 6.1 and 8. Similarity parameters are obtained for heat transfer under conditions of entropy layer absorption by a turbulent boundary layer. The experimental and analytical results are processed in terms of similarity parameters for laminar and turbulent boundary layer flows. The results are then used to obtain interpolation formulas for the heat transfer parameter.

A86-21345 A solution to the problem of flow past wings with allowance for flow separation on the basis of a system of Euler equations (Reshenie zadachi obtekaniia kryl'ev s uchetom otryva potoka na osnove sistemy uravneniia Eilera). A. P. SHASHKIN (AN SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR) *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskie Nauki* (ISSN 0002-3434), Oct. 1985, pp. 34-40 13 refs.

The problem of supersonic flow of a gas past wings is analyzed with allowance for possible flow separation using complete Euler equations. A numerical implementation of such a flow is presented for delta wings with subsonic edges. The results obtained are verified experimentally.

A86-18902 A compressible laminar boundary layer on a plane triangular plate with an attached shock wave (Szhimaemyi laminarnyi pogranichnyi sloi na ploskoi treugol'noi plastine s prisoedinennoi udarnoi volnoi). V. N. VETLUTSKII and T. V. POPLAVSKAIA, *PMTF—Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), Sept.-Oct. 1985, pp. 23-29. 21 refs.

A laminar boundary layer on the windward side of a plane triangular plate is analyzed quantitatively. In particular, expressions are obtained which relate local coefficients of friction resistance and Stanton numbers, as well as integral coefficients of friction resistance and heat fluxes, to the principal parameters of the problem, namely, the Mach number, angle of attack, angle of sweep, and relative wall enthalpy.