Selected Abstracts

from Soviet Aerospace Literature

Throughout 1987 each issue of the *AIAA Journal* will carry selected abstracts on leading research topics from the Soviet aerospace literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features recent fluid dynamics. Support for assembling and publishing the selected abstracts has been provided by the Innovative Science and Technology Directorate of the Strategic Defense Initiative Organization (SDIO), with the cooperation and technical management of the abstract service by the Office of Naval Research (ONR). Abstracts in this listing—identified by the "A" numbers preceding them (which should be used for identifying and ordering material)—have been taken from the semimonthly abstract journal International Aerospace Abstracts (IAA), published by the American Institute of Aeronautics and Astronautics (AIAA) in cooperation with the National Aeronautics and Space Administration (NASA) under Contract No. NASW-4112. Additional material can be obtained through searching the Aerospace Database—available on DIALOG—or NASA RECON. Paper copies and microfiche of documents are available from AIAA Library, Technical Information Service, American Institute of Aeronautics and Astronautics, Inc., 555 W. 57th St., New York, NY 10019 (212) 247-6500, ext. 231. Again, use the "A" number to identify material you want.

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A86-13608   Transition to turbulence, intermittence, and vortex fluctuations (Perekhod k turbulentnosti, peremezhaemost' i fliuktuatsii vikhrei). A. G. BERSHADSKII, *Magnitnaia Gidrodinamika* (ISSN 0025-0015), July-Sept. 1985, pp. 63-70. 12 refs.

A model is developed which describes the fluctuation coalescence of vortices at moderately high Reynolds numbers. The model is found to be in good agreement with experimental data on 1) flow intermittence in a boundary layer, a round jet, and a plane wake; 2) the effect of a magnetic field on the formation of a turbulent energy spectrum behind a grid and on turbulent fluctuations and friction in ducts; 3) formation of a turbulent energy spectrum in a boundary layer and in ducts.

A86-16688   Nonlinear waves and stabilization of a two-dimensional instability in a boundary layer (Nelineinye volny i stabilizatsiia dvumernoi neustoichivosti v pogranichnom sloe). V. P. REUTOV, *PMTF — Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), July-Aug. 1985, pp. 35-42. 18 refs.

The paper is concerned with essentially unstable waves arising on saturation of a two-dimensional instability in an incompressible boundary layer. In particular, attention is given to the case of moderately large Reynolds numbers corresponding to the principal part of the loop of a neutral curve for linear perturbations. The analysis is based on a generalization of the Tollmien method, used for plotting the neutral curve in linear theory, to the case of a nonlinear critical layer. It is shown that the stabilization of a two-dimensional instability is associated with the effect of the critical layer nonlinearity on both the efficiency of the wave-flow resonance interaction and the efficiency of the viscous mechanism of wave destabilization.

A85-28465   A computer simulation of separated flow past a rotating cylinder and the Magnus force reversal (Modelirovanie na EVM otryvnogo obtekaniia vrashchaiushchegosia tsilindra i reversa sily Magnusa). S. M. BELOTSERKOVSKII, V. N. KOTOVSKII, M. I. NISHT, and R. M. FEDOROV, *Inzhenerno-Fizicheskii Zhurnal* (ISSN 0021-0285), Vol. 48, Feb. 1985, pp. 244-250. 8 refs.

A mathematical model describing unsteady separated flow past a rotating cylinder is developed on the basis of the synthesis of the discrete vortex method in boundary layer theory. Results of numerical studies of unsteady separated flow past a smooth cylinder are presented for a specified Reynolds number and various rotation velocities. It is shown that the lifting force acting on the cylinder increases with the rotation velocity (the Magnus effect). However, a reversal of the lifting force can occur under certain flow conditions.

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.

A86-27558   The role of the first and second perturbation modes during the supersonic boundary layer transition (O roli pervoi i vtoroi mod vozmushchenii v protsesse perekhoda sverkhzvukovogo pogranichnogo sloia). V. I. LYSENKO, *PMTF — Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), Nov.-Dec. 1985, pp. 58-62. 14 refs.

The stability characteristics of the first (low-frequency) and second (high-frequency) perturbation modes are compared in order to determine the contributions of these modes to the development of unstable oscillations in a supersonic boundary layer. The effect of the Mach number, temperature factor, pressure gradient, and stagation temperature on the stability characteristics of the two modes is examined.

A85-29918   Stability of a free-convection boundary layer on a vertical permeable plate (Ustoichivost' svobodnokonvektivnogo pogranichnogo sloia na vertikal'noi pronitsaemoi plastine). V. M. EROSHENKO, L. I. ZAICHIK, and V. A. PERSHUKOV (Gosudarstvennyi Nauchno-Issledovatel'skii Energeticheskii Institut, Moscow, USSR) *Inzhenerno-Fizicheskii Zhurnal* (ISSN 0021-0285), Vol. 48, March 1985, pp. 382-387. 11 refs.

The stability of a free-convection boundary layer on vertical permeable and impermeable plates with respect to small perturbations is investigated in the context of linear theory. For flow on an isothermal plate, it is found that as the injection intensity increases, flow stability first decreases and then tends to a constant value corresponding to asymptotically strong injection. For an impermeable nonisothermal surface, it is shown that the critical Grashof number increases linearly with the nonisothermality parameter and the effect of thermal waves on stability becomes more pronounced. The effect of injection on flow stability characteristics is the same for nonisothermal and isothermal plates.

A85-28458   Downstream-displacement of a boundary layer transition by an electrohydrodynamic technique (O zatiagivanii perekhoda pogranichnogo sloia elektrogidrodinamicheskim metodom). A. P. KURIACHII, *Prikladnaia Matematika i Mekhanika* (ISSN 0032-8235), Vol. 49, Jan.-Feb. 1985, pp. 107-114. 11 refs.

It is demonstrated that the application of an electrohydrodynamic (EHD) force to the boundary layer flow can effect the downstream-displacement of the point of laminar-to-turbulent transition. This EHD technique, based on the use of electrostatic volume forces arising in the flow of a charged medium in an electric field, can be an efficient and economical method of boundary layer control. The EHD effect is evaluated on the basis of calculations of the spatial intensification coefficients of small perturbations of Tollmein-Schlichting-wave type in the EHD boundary layer; and the e-exp-n method is used to predict the transition.

A86-29849   Heat and mass transfer and friction in a turbulent boundary layer (Russian book) (Eplomassoobmen i trenie v turbulentnom pogranichnom sloe). S. S. KUTATELADZE and A. I. LEONTEV, *Moscow, Energoatomizdat,* 1985, 320 pp. 133 refs.

Certain conservative properties of a turbulent boundary layer near a wall are examined, with particular attention given to the theory of a turbulent boundary layer with a vanishing viscosity. Methods of applying this theory to the analysis of real flows are discussed, as are the limiting properties of a heat boundary layer on an adiabatic surface, interaction between a submerged jet and a solid, and some other problems related to heat screens. Practical recommendations are given concerning the calculation of friction and heat and mass transfer in the presence of various effects.

A86-33293   Free-surface flows (Russian book) (Techeniia so svobodnymi poverkhnostiami). G. V. LOGVINOVICH, V. N. BUIVOL, A. S. DUDKO, S. I. PUTILIN, and IU. R. SHERCHUK, *Kiev, Izdatel'stvo Naukova Dumka,* 1985, 296 pp. 170 refs.

Results of recent theoretical and experimental research related to free-surface flows are reviewed. Topics discussed include potential flows with free boundaries, axisymmetric cavitation in an ideal fluid, flows in a longitudinal gravitational field, and a wing of low aspect ratio near a curved boundary. Attention is also given to some problems related to perturbations in cavitation flows, the effect of the cavitator orientation on the cavern shape, and liquid rotation in vortex funnels.

A86-35468   Formation of turbulence in shear flows (Russian book) (Formirovanie turbulentnosti v sdvigovykh techeniiakh). L. F. KOZLOV, A. I. TSYGANIUK, V. V. BABENKO, O. D. NIKISHOVA, and G. A. VOROPAEV, *Kiev, Izdatel'stvo Naukova Dumka,* 1985, 284 pp. 403 refs.

Results of theoretical and experimental research related to the formation and development of turbulence in boundary layers and other shear flows are reviewed. New models are proposed for calculating boundary layer characteristics for bodies with a positive (in the presence of a jet) and a large negative curvature and also for compliant surfaces. The performance of compliant surfaces under conditions of turbulent energy absorption is analyzed. The discussion also covers the hydrodynamic stability and formation of Taylor-Goertler vortices and the susceptibility of perturbations in the boundary layer.

A86-36683   Nonlocal hydrodynamic models of flows in the transition region (Nelokal'no-gidrodinamicheskie modeli techenii v perekhodnoi oblasti). T. A. KHANTULEVA and A. A. RODIONOV, IN: Molecular gas dynamics and rarefied-gas dynamics. Part 1 (A86-36676 16-34), *Moscow, AN SSSR, Institut Problem Upravleniia,* 1985, pp. 226-249. 19 refs.

A new approach to the description of the transition mode is proposed which is based on the equations of generalized nonlocal hydrodynamics. It is shown that nonlocal hydrodynamic models applicable to the transition region make it possible to account for the kinetic effects directly in the hydrodynamic balance equations. It is noted, however, that the nonlocal description has a more general meaning and can be applied to systems for which rigorous kinetic approaches have not been developed. The effect of nonlocal phenomena on hydrodynamic profiles in boundary layers are examined using specific examples.

A86-36685   A numerical study of flow of a weakly rarefied gas past bodies of finite dimensions (Chislennoe issledovanie obtekaniia tel konechnykh razmerov potokom slaborazrezhennogo gaza). E. N. LYCHKIN, IN: Molecular gas dynamics and rarefied-gas dynamics. Part 1 (A86-36676 16-34). *Moscow, AN SSSR, Institut Problem Upravleniia,* 1985, pp. 258-269. 12 refs.

Flow of a weakly rarefied gas at zero angle of attack past blunt bodies of revolution of finite dimensions with small and large aspect ratios is investigated using a continuum model. The analysis is carried out using the deformation-flow method, a modification of the method of flows proposed by Belotserkovskii and Severinov (1973). The effects of viscosity, heat conduction, and slip on flow characteristics are determined for the entire region perturbed by the body; the applicability region of the scheme used here is defined.

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.

A86-35994   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.

A86-36676   Molecular gas dynamics and rarefied-gas dynamics. Parts 1 & 2 (Molekuliarnaia gazovaia dinamika i dinamika razrezhennogo gaza. Parts 1 & 2). V. V. STRUMINSKII, Ed., *Moscow, AN SSSR, Institut Problem Upravleniia,* 1985. Pt. 1, 278 pp.; Pt. 2, 268 pp. (For individual items refer to A86-36677—A86-36690)

The papers presented in the two volumes provide an overview of recent theoretical and experimental research related to the main problems in molecular gas dynamics and rarefied-gas dynamics. Topics discussed include the kinetic theory of gases and gas mixtures, gas dynamics with allowance for internal degrees of freedom, free-molecule flows and the interaction of gases with solid surfaces, experimental and theoretical methods of investigating flows of rarefied gases and plasmas, and some problems in chemical process technology.

A86-35975   Iterative methods for solving gasdynamic equations (Ob iteratsionnykh metodakh resheniia uravnenii gazovoi dinamiki). A. I. ZUEV and V. G. NIKOLAEV, *Zhurnal Vychislitel'noi Matematiki i Matematicheskoi Fiziki* (ISSN 0044-4669), Vol. 26, March 1986, pp. 408-416. 7 refs.

The paper describes iterative methods for solving nonlinear systems of difference equations, written in divergent and nondivergent forms, and approximating the gasdynamic equations for a heat-conducting gas. For divergent equations with allowance for physical viscosity, all the methods considered are applicable in the case of plane geometry; for nondivergent equations, some of them can be used after obvious modification in the case of arbitrary one-dimensional geometry. The effectiveness of the proposed method is illustrated by the solution of certain model problems.

A86-39665   The effect of injection on supersonic flow of a dusty gas around a blunt body (Vliianie vduva na sverkhzvukovoe obtekanie zatuplennogo tela zapylennym gazom). IU. P. GOLOVACHEV and A. A. SHMIDT, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Mar.-Apr. 1986, pp. 178-181. 8 refs.

The effectiveness of cold gas injection as a method of protecting the surfaces of a flight vehicle against erosion is investigated with reference to supersonic flow past a sphere. The problem is solved using a two-layer model, with the values of the gasdynamic functions behind the bow shock determined from the Rankine-Hugoniot relations. An analysis of the results obtained indicates that the injection method provides an efficient way for protecting surfaces against the erosion effect of the impurity phase.

A85-42123   Stability characteristics of a supersonic boundary layer and their relation to the position of the laminar-turbulent transition point (Kharakteristiki ustoichivosti sverkhzvukovogo pogranichnogo sloia i ikh sviaz' s polozheniem perekhoda laminarnogo pogranichnogo sloia v turbulentnyi). V. I. LYSENKO (AN SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR) *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskie Nauki* (ISSN 0002-3434), March 1985, pp. 79-86. 13 refs.

By comparing the calculated results with experimental data, it is demonstrated that the position of the laminar-boundary transition point of a boundary layer can be estimated by using the e-exp-n method. The effect of the Mach number, pressure gradient, and heat transfer on the laminar-turbulent transition is discussed. It is found that under conditions of strong cooling, the effect of the pressure gradient on the position of the transition point is less pronounced than in the absence of heat transfer.

A86-43370   Solution of problems of conjugate heat transfer during flow past bodies of different shape (Reshenie zadach sopriazhennogo teploobmena pri obtekanii tel razlichnoi formy). V. I. ZINCHENKO and E. N. PUTIATINA, *PMTF — Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), Mar.-Apr. 1986, pp. 85-93. 19 refs.

An analysis is made of unsteady heat transfer during the supersonic flow of an ideal gas past axisymmetric bodies of resolution of different shape for Reynolds numbers corresponding to different flow regimes in the boundary layer. Numerical and analytical solutions for heat flux from a non-isothermal surface are compared for laminar flow regimes. It is shown that, in the laminar case, the heat flux to the body has a structure connected with the preliminary development history of the thermal and dynamic boundary layer, and with the value of the local derivative of surface temperature. For certain surface shapes, the use of accepted formulas for the heat transfer coefficient leads to significant errors in the separable formulation of the problem of determining the temperature field in the body.

A86-39666   Characteristics of hypersonic flow around models in wind tunnels of various classes (Osobennosti giperzvukovogo obtekaniia modelei v aerodinamicheskikh trubakh razlichnogo klassa). V. I. ALFEROV, A. P. LABAZKIN, and A. P. RUDAKOVA, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Mar.-Apr. 1986, pp. 181-184. 12 refs.

Results of experimental studies of supersonic flow around a hemisphere and cones with large half-angles of taper (40-65 deg) in wind tunnels of various types are reported. In particular, it is shown that in tunnels with electric-arc heating of the gas in the precombustion chamber and in a hypersonic wind tunnel, flow around cones is characterized by the formation of a relaxation entropy layer. It is further shown that real gas effects in the case of hypersonic flow are best reproduced in the hypersonic wind tunnel.

A86-43372   Calculation of nonequilibrium parameters of air on the surfaces of models and in their wakes for aeroballistic-experiment conditions (Raschet neravnovesnykh parametrov vozdukha na poverkhnosti modelei i v sledakh za nimi dlia uslovii aerobal-listicheskikh eksperimentov). I.G. EREMEITSEV and N. M. PILIUGIN, *PMTF— Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), Mar.-Apr. 1986, pp. 101-111. 16 refs.

A single algorithm is presented for the computer calculation of the direct and inverse quasi-one-dimensional problem concerning the flow of chemically nonequilibrium 18-component air. Numerical-solution examples are presented, involving supersonic flow in nozzles and hypersonic flow past bodies flying at hypersonic speed. Nonequilibrium parameters along the surfaces of models and in their near wakes are calculated for aeroballistic-experiment conditions. The solution of certain novel variational problems of nonequilibrium aerodynamics is considered.

A86-45343   A numerical scheme for the solution of the Navier-Stokes equations (Ob odnoi chislennoi skheme resheniia uravnenii Nav'e-Stoksa). V. M. KRIVTSOV, *Zhurnal Vychislitel'noi Matematiki i Matematicheskoi Fiziki* (ISSN 0044-4669), Vol. 26, June 1986, pp. 914-923. 18 refs.

A difference scheme for the solution of the Navier-Stokes equations is proposed which is conditionally stable, and is first-order-accurate in time and second-order-accurate in space. Calculation results are presented for viscous-gas flow near an infinitely thin plate at angle of attack.

A86-38299   Heat and mass transfer and hydrodynamics of turbulent flows (Russian book) (Teplomassoobmen i gidrodinamika turbulizirovannykh potokov). E. P. DYBAN and E. IA. EPIK, Kiev, *Izdatel'stvo Naukova Dumka*, 1985, 296 pp. 336 refs.

Experimental data are presented on the microstructure of heat transfer agent flows in full-scale machines and apparatus and associated boundary layers. Particular attention is given to methods and equipment for measuring turbulence characteristics and methods for modeling turbulent flows in the laboratory. Data are also presented on the effect of amplitude and frequency (scale) characteristics of turbulence on the intensity of transfer processes in wall boundary layers, separated flows, and surfaces of machine components. Empirical, semiempirical, and numerical methods for calculating heat and mass transfer in turbulent flow are discussed.

A86-39660   Lifting bodies designed for flow behind axisymmetric conical shock waves (Nesushchie tela, postroennye na techeniia za osesimmetrichnymi konicheskimi skachkami uplotneniia). V. I. VORONIN and A. I. SHVETS, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Mar.-Apr. 1986, pp. 135-138.

A numerical solution is presented for the problem of flow past lifting bodies designed for flow behind axisymmetric conical shock waves with half-angles of taper of 9.5 and 18 deg. The leading edge of the bodies considered here is located below the apex of the conical shock wave; the upper surfaces of the bodies are formed by intersecting planes parallel to the velocity vector of the oncoming flow. The solution presented here has been implemented in computer software. Results of calculations are presented in graphic form.

A86-39656   Flow in the vicinity of the stagnation point of an axisymmetric wake (O techenii v okrestnosti tochki tormozheniia osesimmetrichnogo sleda). V. N. TRIGUB, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Mar.-Apr. 1986, pp. 53-59. 6 refs.

Solutions to parabolic equations describing axisymmetric wake flows due to viscosity and pressure gradients are examined. It is shown that, in the general case, the solution in the vicinity of the stagnation point at the wake axis is singular and cannot be extended beyond the stagnation point. In addition, a regular solution near the stagnation point and a singular solution extendable downstream are obtained. The singular solution is shown to be a limiting case of a class of regular solutions.

A86-44698   Using thermal radiation detectors for studying aerodynamic heating at hypersonic flow velocities (Primenenie priemnikov teplovogo izlucheniia dlia issledovaniia aerodinamicheskogo nagreva pri giperzvukovykh skorostiakh potoka). O. A. GERASHCHENKO, E. I. AVERKOV, M. A. GOLDFELD, G. A. KISELEV, and I. I. KLIMENKO (AN USSR, Institut Tekhnicheskoi Teplofiziki, Kiev, Ukrainian SSR; Novosibirskii Elektrotekhnicheskii Institut, Novosibirsk, USSR); et al. *Promyshlennaia Teplotekhnika* (ISSN 0204-3602), Vol. 8, No. 2, 1986, pp. 74-76. 6 refs.

The thermal fluxes of a cylindrical nozzle with an internal cavity have been measured using a thermal radiation detector. It is shown that heat transfer is significantly intensified in a finely dispersed heat-insulating material due to the mechanical and acoustic effect of hypersonic flow. Intense generation of heat fluxes also occurs in conical cavities forming the heat-sensitive surface of the radiometer.

A86-44754   A method for the standardized calculation of gas flows in a region with an arbitrary boundary (Metod unifitsirovannogo rascheta techenii gaza v oblasti s proizvol'noi granitsei). B. P. GERASIMOV, A. B. KARAGICHEV, and S. A. SEMUSHIN (AN SSSR, Institut Prikladnoi Matematiki, Moscow, USSR) *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 288, No. 2, 1986, pp. 331-336. 8 refs.

A unified approach is proposed for the finite-difference calculation of two- and three-dimensional nonstationary gas flows on a Cartesian or cylindrical rectangular stationary Euler grid in a region of arbitrary complex form that may vary with time. Stationary solutions are obtained by using a finite-difference scheme in time; calculations for the boundary and internal cells are carried out using unified difference formulas. Since mostly coarse grids are used, it is essential that the difference scheme be conservative. The conservativeness of both the difference scheme and the boundary conditions is ensured by using the integrointerpolation method.

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.

A86-45231   A quasi-one-dimensional model for the evolution of the turbulent wake of a body in a stratified medium (Kvaziodnomernaia model' evoliutsii v stratifitsirovannoi srede turbulentnoi oblasti sleda za telom). L. I. SKURIN (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR) *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana* (ISSN 0002-3515), Vol. 22, April 1986, pp. 373-379. 13 refs.

The time dependence of the sizes of plane turbulent spots in a stratified medium is described. The plane turbulent spots are studied under conditions where the pulsation Froude number values are large and the volume increases in the region considered due to turbulent diffusion is substantial. A system of equations for the evolution of such spots in a quasi-one-dimensional approximation is derived, and conditions under which the viscous stage of evolution occurs are established. The evolution of the turbulent wake of a hypersonic vehicle is considered.

A85-48404   Using small localized surface vibrations for controlling the transition process in a boundary layer (Ispol'zovanie malykh lokalizovannykh vibratsii poverkhnosti dlia upravleniia protsessom perekhoda v pogranichnom sloe). V. M. GILEV and V. V. KOZLOV (AN SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR) *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskie Nauki* (ISSN 0002-3434), June 1985, pp. 116-119. 5 refs.

Results of an experimental study of the effect of small surface vibrations on the laminar-turbulent transition in a boundary layer are reported. The experiment, carried out in a low-turbulence subsonic wind tunnel using a flat plate, shows that small surface vibrations localized in space provide a way to control the laminar-turbulent transition point.

A85-44783 **Stability of a subsonic boundary layer during the heating of the surface of a flat plate near the leading edge (Ob ustoichivosti dozvukovogo pogranichnogo sloia pri nagreve poverkhnosti ploskoi plastiny vblizi perednei kromki).** A. V. KAZAKOV, M. N. KOGAN, V. A. KUPAREV, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), May-June 1985, pp. 68-72. 10 refs.

The possibility of increasing flow stability in the boundary layer by heating the surface of a body near its leading edge, and thus raising the temperature of the gas in the boundary layer, is investigated analytically. It is shown that an increase in the surface temperature near the leading edge of a plate results in increased flow stability with respect to two-dimensional perturbations, with a loss of stability occuring at higher critical Reynolds numbers. The laminar-turbulent transition point shifts further downstream.

A85-44149 **Resonant interaction of three-dimensional perturbations in a boundary layer (O rezonansnom vzaimodeistvii prostranstvennykh vozmushchenii v pogranichnom sloe).** M. B. ZELMAN and I. I. MASLENNIKOVA, *PMTF — Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* (ISSN 0044-4626), May-June 1985, pp. 86-90. 12 refs.

The interaction of perturbations in asymmetric triplets is studied theoretically on the basis of an isolated T-S wave triplet model, and a comparison is made with experimental data. It is found that this interaction plays an important role in the formation of the three-dimensional structure and spectrum of the initial stage of transition to turbulence in a boundary layer. This mechanism is characterized by the predominant transfer of energy to low-frequency oscillations, which can lead to the cascade excitation of spatial fluctuations of longer wavelength.

A86-43399 **Friction and heat release of a laminar incompressible flow with a large negative longitudinal pressure gradient (Trenie i teplootdacha laminarnogo neszhimaemogo potoka s bol'shim otritsatel'nym prodol'nym gradientom davleniia).** N. N. KOVALNOGOV and D. L. KUZNETSOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 1, 1986, pp. 93-95.

The paper presents a numerical study of friction and heat release in laminar incompressible flow with a large negative pressure gradient for different Pr numbers. The integration of the boundary layer equations together with the boundary conditions is carried out on the basis of an implicit six-point difference scheme. The local and integral characteristics are determined on the basis of an investigation of the structure of the thermal and dynamic boundary layers in given cross sections.

A86-45344 **Calculation of the explosion of a rapidly flying body (K raschetu vzryva bystro letiashchego tela).** L. V. SHURSHALOV, *Zhurnal Vychislitel'noi Matematiki i Matematicheskoi Fiziki* (ISSN 0044-4669), Vol. 26, June 1986, pp. 924-933. 9 refs.

The paper formulates the problem of the explosion of a rapidly flying body, considered as a spherical gas volume characterized by high explosion energy and a high translational velocity. An algorithm for solving the problem is proposed which, together with the conventional divergent system of gasdynamic equations, uses nondivergent equations for the kinetic and internal energy of the gas, and a difference grid moving with the exploding body. Attention is given to cases of the explosion of gas volumes moving at velocities corresponding to $M = 3$ and $M = 30$.

A86-39653 **Laser calorimetric spectroscopy in flow analyses (Lazernaia kalorimetricheskaia spektroskopiia v potokakh).** V. P. ZHAROV *(Moskovskoe Vysshee Tekhnicheskoe Uchilishche, Moscow, USSR);* N. M. AMER, (University of California, Berkeley) [Vsesoiuznaia Konferentsiia po Kogerentnoi i Nelineinoi Optike, 12th, Moscow, USSR, Aug. 26-29, 1985] Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia (ISSN 0367-6765), Vol. 50, April 1986, pp. 820-827. 18 refs.

The calorimetric deflection method of laser spectroscopy was expanded and adapted to the analyses of fluid flows. The method involves the measurement of the delay time between two deflection signals resulting from successive intersections of the heated zone by two beams running in parallel. The method simultaneously measures flow velocity, particle concentration, and flow temperature, and is most sensitive in the range between 0.1 and 100 cm[s. The method can be applied to studies of turbulent media, flames, flow-injection analyses, and gases and liquids near their critical points.