

Russian and Japanese Aerospace Literature

During 1995 the *AIAA Journal* will carry selected abstracts on leading research topics from Russian aerospace literature and, as space permits, from similar Japanese literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features Structural and Aerodynamic Optimization from Russia and Aluminium Alloys from Japan.

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Russian Aerospace Literature This month: *Structural and Aerodynamic Optimization*

A94-23839 Performance limits of multilayer composite structures (Predel'nye vozmozhnosti mnogoslojnykh kompozitnykh struktur). P. A. ZINOV'EV and A. A. SMERDOV, *Rossiyskaya Akademiya Nauk, Izvestiya, Mekhanika Tverdogo Tela* (ISSN 0572-3299), NO. 1, Feb. 1994, pp. 7-17. 8 Refs. Documents available from Aeroplus Dispatch.

The properties of multilayer composite structures are examined in the plane case using a structural-phenomenological approach. The approach is based on the phenomenological description of the smallest structural element (unidirectional or cross-reinforced monolayer) and the numerical derivation of the properties of the multilayer structure from the data obtained for the basic structural element. For the computational model adopted here, the construction of performance limit surfaces is illustrated by specific examples.

A93-47087 Rating the load-bearing capacity of a structure under nonstationary random loading (Normirovanie nesushchej sposobnosti konstruktov pri nestatsionarnom sluchajnom vozdejstvii). E. H. I. MINORANSKIY, S. A. MIKHAILOV, and O. L. SYCHEV, In *Problems of the strength and fatigue of the elements of aircraft structures* (A93-47076 19-39). Kuibyshev, Russia, Kuibyshevskij Aviatsonnyj Institut, 1990, pp. 76-82. 3 Refs. Documents available from Aeroplus Dispatch.

A method for rating the load-bearing capacity of flight vehicle structures is presented which is based on the general principles of reliability. The method makes it possible to establish relationships for design loads and standard safety margins as a function of the normalized reliability of a flight vehicle as a whole and statistical characteristics of external loads with allowance for their variability with time. A Poisson failure model is employed; the structure is represented in terms of a finite element model, and the statistical dynamics problem is solved by the method of interpolation polynomials.

A93-47085 Optimization of an aeroelastic system using the dynamic stability condition (Optimizatsiya aehrouprugoj sistemy po usloviyam dinamicheskoy ustojchivosti). T. V. GRISHANINA, and F. N. SHKLYARCHUK, In *Problems of the strength and fatigue of the elements of aircraft structures* (A93-47076 19-39). Kuibyshev, Russia, Kuibyshevskij Aviatsonnyj Institut, 1990, pp. 66-72. 5 Refs. Documents available from Aeroplus Dispatch.

A study is made of the natural vibrations of a linear aeroelastic system with a finite number of degrees of freedom. The dynamic characteristics of modified structures are determined by using the perturbation method. To increase the dynamic stability, the selected system parameters are varied in accordance with the gradient steepest descent method. The problem of increasing the flutter stability margin of an adjustable stabilizer in supersonic flow is considered as an example.

A93-47076 Problems of the strength and fatigue of the elements of aircraft structures (Voprosy prochnosti i dolgovechnosti ehlementov aviatsonnykh konstruktov). Kh. S. KHAZANOV, Ed., Kuibyshev, Russia, Kuibyshevskij Aviatsonnyj Institut, 1990, p. 145 (For individual items see A93-47077 to A93-47095).

The papers presented in this volume focus on analytical and numerical methods for the study of the statics, dynamics, and stability of thin-walled structures, fracture mechanics, fatigue strength, and reliability of aircraft structures. Specific topics discussed include a finite element algorithm for studying

the nonlinear deformation and stability of structurally orthotropic cylindrical shells, construction of stiffness matrices in nonlinear finite element analysis, and using the quadrature method for the stability analysis of rods of variable cross section. Other topics discussed include optimization of an aeroelastic structure using the dynamic stability condition, dynamic analysis of a compound elastic surface, and using the finite element method in the statistical prediction of fatigue strength.

A93-45659 Problems in the aerodynamics, strength, and flight operations of aircraft (Voprosy aehrodinamiki, prochnosti i letnoj ehkspluatatsii vozdukhnykh sudov). S. Yu. SKRIPNICHENKO, Ed., Moscow, Gosudarstvennyj Nil Grazhdanskoj Aviatcii (GosNIIGA, Trudy, No. 300), 1991, p. 104 (For individual items see A93-45660 to A93-45675).

The papers presented in this volume focus on the methodological aspects and results of the flight testing of civil aircraft, aircraft operation, monitoring of the condition of runways, and problems of fuel efficiency in flight operations. Other topics discussed include the prediction of fatigue crack growth kinetics in the structural elements of aircraft under biaxial loading, calculation of the position of the aircraft center of gravity on an IBM PC computer, spectroscopic analysis of aircraft loading in ground operations, and calculation of safe altitudes.

A93-43831 Fundamentals of flight vehicle design (Russian book) (Osnovy ustrojstva i konstruirovaniya letatel'nykh apparatov). V. N. NOVIKOV, B. M. AVKHIMOVICH, and V. E. VEJTIN, Moscow, *Izdatel'stvo Mashinostroenie*, 1991, p. 368. 17 Refs.

The fundamentals of the design of flight vehicles are presented from the standpoint of systems design whereby the flight vehicle is treated as part of a large engineering system. The discussion covers the principles of controlled flight, types and characteristics of onboard equipment, control systems, and powerplants. Particular attention is given to the characteristics of a design that unifies all the subsystems into one whole. Consideration is also given to the design of flight vehicle components and units, algorithms for the selection of the parameters of individual units and parts with allowance for the complex interaction with the environment, and solving problems arising from the computer-aided design of flight vehicles.

A93-43076 A parameter space analysis method and multicriterial optimization by using finite element models (Metod issledovaniya prostanstva parametrov i mnogokriterial'naya optimizatsiya ob'ektov s ispol'zovaniem konechno-ehlementnykh modelej). R. B. STATNIKOV, I. B. MATUSOV, P. V. MIODUSHEVSKIY, Yu. Yu. UZVOLOK, D. S. FELDMAN, Yu. A. SHEVCHENKO, and V. S. SHENFELD, (RAN, Inst. Mashinovedeniya; TsAGI, Moscow, Russia), *Rossiyskaya Akademiya Nauk, Doklady* (ISSN 0869-5652), Vol. 329, No. 1, March 1993, pp. 17-21. 5 Refs. Documents available from Aeroplus Dispatch.

The use of the parameter space analysis method for optimizing structures described by finite element models provides a convenient way to correctly synthesize a set of geometric shapes for the structure to be optimized. The resulting shapes constitute a set of multivariant object visualizations. The efficiency of this approach is illustrated by an example involving the optimization of an automobile chassis. The optimization procedure has made it possible to reduce the chassis weight by 28 kg while improving its overall quality.

A93-42381 Characteristics of data processing during the development of a data base for a CAD system for aircraft design (Osobennosti obrabotki informatsii pri formirovanii bazy dannykh SAPR samoletov). A. M. IVANOV, In *Current methods of selecting the configurations and parameters of flight vehicles* (A93-42369 17-05). Moscow, Moskovskij Aviatsonnyy Institut, 1990, pp. 78-83. Documents available from Aeroplus Dispatch.

The principal types of information that must be included into the data base of any CAD system for aircraft design are defined. The information that must be included covers technical contradictions and competing technical factors, technical solutions and technical solution rating in terms of cost factors, practical implementations of technical solutions, and criteria for selecting optimal technical solutions among various alternatives. As an example, swept wings with fixed and adjustable sweep angle are analyzed as two alternative technical solutions for several different types of aircraft.

A93-39793 Dynamics and stability of composite laminates (Dinamika i ustoiichivost' sloistykh kompozitnykh materialov). GUZ', N. ALEKSANDR, Ed., Kiev, *Izdatel'stvo Naukova Dumka*, 1992, p. 368.

The book is concerned with the fundamental and applied aspects of the dynamics of composite laminates. The propagation of surface and bulk waves is examined in the context of a piecewise homogeneous medium model using a three-dimensional formulation. The internal and surface instabilities are analyzed, and the continuum approximation in the stability theory is demonstrated. Various approaches are developed for constructing continuum approximations in the mechanics of composite laminates using rigorous and approximate descriptions of component interaction. An analysis is made of the dynamics properties of laminated components in which damping is introduced by means of viscoelastic layers.

A93-39180 Selection of the scheme and optimal parameters of the turbine of a high-temperature bypass engine with a low bypass ratio (Vybor skhemy i optimal'nykh parametrov turbiny vysokotemperaturnogo TRDD s maloi stepen'iu dvukhkoturnosti). S. D. GRITSAL, O. N. EMIN, V. I. KUZNETSOV, and S. L. MKHITARIAN, *Aviatsonnaia Tekhnika* (ISSN 0579-2975), No. 4, 1992, pp. 22-24. 5 Refs. Documents available from Aeroplus Dispatch.

An analysis is made of the operating conditions of the turbine stages of a stoichiometric two-shaft bypass engine with a low bypass ratio with attached low-pressure compressor (fan) stages. The optimization of the principal parameters of the turbine stages is carried out using a specially developed computer program. To further enhance the aerodynamic characteristics of the turbine cascades and cooling systems of such a bypass engine layout, the use of a birotary two-stage turbine without an intermediate nozzle vane cascade is recommended.

A93-36800 Optimal design of honeycomb sandwich shell aircraft structures of composite materials (Ratsional'noe proektirovanie trekhslonnykh sotovykh obolocheknykh aviakonstruktsii iz kompozitsionnykh materialov). Iu. F. KRASHAKOV, and S. M. KHOKHLENKOV, In *Stress-strain analysis and optimal design of aircraft structures* (A93-36782 14-39). Moscow, *Izdatel'skii Otdel TsAGI*, 1992, pp. 157-165. 3 Refs. Documents available from Aeroplus Dispatch.

Methods for optimizing the design of sandwich composite shells with a honeycomb core are presented using a helicopter tail boom structure as an example. In particular, attention is given to the minimum-mass design using criteria of local and general stability, strength, and stiffness in the presence of structural and technological constraints. The characteristics of two shell structures, one fabricated by the layup method and the other by winding with a varying reinforcement angle, are compared.

A93-36798 A study of the effect of the static aeroelasticity of a swept wing on its weight response (Issledovanie vlianiia staticheskoi aeroprugosti strelovidnogo kryla na ego vesovuiu otdachu). V. A. BELOUS, and V. I. BIRIUK, In *Stress-strain analysis and optimal design of aircraft structures* (A93-36782 14-39). Moscow, *Izdatel'skii Otdel TsAGI*, 1992, pp. 145-149. Documents available from Aeroplus Dispatch.

A methodology is presented for solving the problem of determining the effect of elasticity on the mass characteristics of a swept wing at the design stage. The methodology is implemented in a set of software which includes a finite element optimization program, a program for calculating pressures in terms of wing surface deformations, a program for preparing initial data using the finite element method, and a program for processing the output data. Calculations of the mass of the load-bearing elements of a swept wing in relation to its aerodynamic characteristics are presented as an example.

A93-36793 A method for the optimum design of a large-aspect-ratio wing (Metodika ratsional'nogo proektirovaniia kryla bol'shogo udlineniia). V. P. FOMIN, In *Stress-strain analysis and optimal design of aircraft structures* (A93-36782 14-39). Moscow, *Izdatel'skii Otdel TsAGI*, 1992, pp. 92-104. 4 Refs. Documents available from Aeroplus Dispatch.

A method is presented for the design of a large-aspect-ratio wing box that is nearly optimal with respect to mass and strength characteristics, while satisfying constraints on permissible stresses, local stability, and load-bearing capacity. The principal stages of the computer-aided design process and strength analysis are reviewed. The design allows for the main characteristics of the nonlinear behavior of the structural elements, including plasticity, buckling, and failure. The application of the methodology described here is illustrated by examples.

A93-36789 Optimization of the stiffness and mass characteristics of lifting surface structures modeled by an elastic beam (Optimizatsiia zhestkostnykh i massovykh kharakteristik konstruktsii nesushchikh poverkhnostei, modeliruemykh uprugoi balkoi). E. K. LIPIN, and V. V. CHEDRIK, In *Stress-strain analysis and optimal design of aircraft structures* (A93-36782 14-39). Moscow, *Izdatel'skii Otdel TsAGI*, 1992, pp. 66-77. 2 Refs. Documents available from Aeroplus Dispatch.

A method and a program for the design analysis of the lifting surface structures of aircraft using a beam computational scheme are described which involve solving the mass minimization problem for a structural material with constraints on strength and stiffness. Strength constraints are specified in the form of permissible stresses; stiffness constraints are formulated as bounds on transverse displacements and increments of the flow angles of attack for the end section for several loading schemes. The results are compared with those of a finite element analysis.

A93-36786 Stability of a multispan panel under combined loading (Ustoiichivost' mnogoproletnoi paneli pri kombinirovannom nagruzhении). A. A. BELOUS, and S. P. BARBA, In *Stress-strain analysis and optimal design of aircraft structures* (A93-36782 14-39). Moscow, *Izdatel'skii Otdel TsAGI*, 1992, pp. 40-45. 4 Refs. Documents available from Aeroplus Dispatch.

An analysis is made of the general buckling mode of a continuous panel loaded by normal and tangential forces. The interaction between the ribs and the panel is described using generalized functions; the effect of the rib stiffness on the critical load is analyzed. An approximate method for the stability analysis of a continuous panel under combined loading is proposed which is based on the Papkovitch theorem concerning the convexity of a boundary surface.

A93-36783 Capabilities, structure, and the current status of the OTSEK software set (Vozmozhnosti, struktura i sostoianie razrabotki kompleksa programm OTSEK). V. F. VOROB'EV, V. A. DUBINIA, Iu. I. DUDAR'KOV, G. N. ZAMULA, I. A. KOVAL', and E. N. SINITSYN, In *Stress-strain analysis and optimal design of aircraft structures* (A93-36782 14-39). Moscow, *Izdatel'skii Otdel TsAGI*, 1992, pp. 5-20. 8 Refs. Documents available from Aeroplus Dispatch.

The specialized software set OTSEK is designed for the analysis of the general stress-strain state, stability, and oscillations and for the optimization of thin-walled reinforced structures using the finite element method. The programs are written in FORTRAN and run on any computers of the ES series using the OS operating system. The discussion covers a general description of the software and its structure, examples of software applications, and the main directions of further development.

A93-36782 Stress-strain analysis and optimal design of aircraft structures (Raschety napriazhenno-deformirovannogo sostoiianiia i ratsional'noe proektirovanie aviatsionnykh konstruktsii). I. A. LIAKHOVENKO, Ed., Moscow, *Izdatel'skii Otdel TsAGI* (TsAGI, Trudy, No. 2495), 1992, p. 166 (For individual items see A93-36783 to A93-36800).

The papers contained in this volume present results of theoretical and experimental research related to the stress-strain analysis and optimal design of aircraft structures. Topics discussed include a study of the origin of residual stresses and strains in the transparencies of supersonic aircraft, methodology for studying the fracture of aircraft structures in static tests, and the stability of a multispan panel under combined loading. The discussion also covers optimization of the stiffness and mass characteristics of lifting surface structures modeled by an elastic beam, a study of the strength of a closed system of wings, and a method for the optimal design of a large-aspect-ratio wing.

A93-35296 Ways of increasing the reliability of large composite structures using dynamic modeling methods (Puti povysheniia nadezhnosti krupnogabaritnykh konstruktsii iz KM metodami dinamicheskogo modelirovaniia). M. V. ALEKSANOVA, A. I. STANKEVICH, V. I. REZNICHENKO, S. N. KUZNETSOV, V. A. KOZLOV, In *Ensuring the reliability and service life of flight vehicle structures by engineering methods* (A93-35276 13-39). Moscow, *Izdatel'stvo Moskovskogo Aviatsonnogo Instituta*, 1991, pp. 81-86. Documents available from Aeroplus Dispatch.

The advantages of using dynamically similar models for optimizing the design of large composite structures are briefly discussed. The development of a dynamically similar model is illustrated for the case of a wing box made of carbon composite elements. The calculated dynamic characteristics of the structure are found to be in good agreement with experimental data, which validates the approach proposed here.

A93-35286 Mathematical statement of the problem of optimizing the design of an airframe for ease of manufacture (Matematicheskaiia postanovka zadachi obrabotki na tekhnologichnost' konstruktsii uzla planera LA). A. G. GROMASHEV, and N. M. KISELEV, In *Ensuring the reliability and service life of flight vehicle structures by engineering methods* (A93-35276 13-39). Moscow, *Izdatel'stvo Moskovskogo Aviatsonnogo Instituta*, 1991, pp. 37-43. Documents available from Aeroplus Dispatch.

The use of computers for solving the problem of geometrical compatibility between the component to be manufactured and the process equipment used makes it possible to interactively solve the problem of the accessibility of mechanical joints at the design stage. At this stage, the geometry of the joint area can be modified to ensure its accessibility, and the types of tools and equipment that are particularly suitable for producing a given mechanical joint can be specified in the technical documentation. Here, this problem is

formulated mathematically, and the mathematical model is demonstrated for a structural element of an airframe.

A93-32188 Local strength of the structural elements of heat exchangers (Mestnaia prochnost' elementov konstruktii teploobmennikov). A. M. KHOMIAKOV, in *Vibrations, deformations, and strength of flight vehicle engine structures* (A93-32182 12-07). Moscow, Izdatel'stvo Moskovskogo Aviatsonnogo Instituta, 1991, pp. 23-30. 3 Refs. Documents available from Aeroplus Dispatch.

The load-bearing capacity of plates with circumferential and circumferential radial reinforcements is determined by the load-bearing capacity of the sections delimited by the reinforcement elements. Expressions for determining the limiting stress of such plates are obtained which can be used for calculating the optimal circumferential and circumferential-radial reinforcements for such plates. Two specific problems are examined as an example.

A93-31201 Current problems in the dynamics and design of mechanisms and machines (Russian book) (Sovremennye problemy dinamiki i konstruirovaniia mekhanizmov i mashin). V. N. KESTELMAN, Ed., Moscow, Izdatel'stvo Moskovskogo Aviatsonnogo Instituta, 1991, p. 68.

The papers contained in this volume deal with possible ways of improving the dynamic and structural properties of machines and mechanisms and also with problems associated with the design of aircraft equipment. Topics discussed include estimation of the stressed state of a model of an orbital film structure, a study of the operation of an aerodynamic angle transducer in flow of a hot gas, calculation of the efficiency of aircraft gear drives, and dynamic accuracy of a controlled manipulator. Papers are also presented on optimal synthesis of mechanical systems with variable properties, synthesis of mechanisms using initial kinematic chains, and using shape memory materials in the design of machines and mechanisms.

A93-31151 Improving the accuracy of estimation of the effect of structural element optimization (Utochnenie otsenki efekta optimizatsii elementov konstruktii). A. M. ARASLANOV, *Aviatsonnaia Tekhnika* (ISSN 0579-2975), No. 3, 1992, pp. 3-5. Documents available from Aeroplus Dispatch.

The use of probabilistic approaches and quantitative reliability criteria for obtaining more accurate estimates of the effect of structural element optimization is discussed. It is shown, in particular, that the existing probability measures of various parameters characterizing the stochastic interaction of a structural element with the environment can be used to obtain quantitative estimates of reliability indices from the regulated parameters which define the behavior of the structure from a certain standpoint. The optimization of a simple cantilever beam is considered as an example.

A93-27606 Calculation of a gas feed system with a gas cylinder (K raschetu ballonnnoi sistemy podachi gaza). L. S. VEROVSKII, and V. P. KAZANTSEV, *Aviatsonnaia Tekhnika* (ISSN 0579-2975), No. 2, 1992, pp. 24-27. 7 Refs. Documents available from Aeroplus Dispatch.

A method is proposed for optimizing the parameters of a gas feed system with a gas cylinder for minimum mass and dimensions. The approach used here is based on the consideration and description, in explicit form, of the relationship between the dynamic and design parameters of the system using equations obtained by a previously developed method (Verovskii, 1990). The principal stages of the optimization procedure are summarized.

A93-25632 Efficiency of a radar-radiometric method of remote sensing in the case of the detection and recognition of underlying-surface inhomogeneities (Effektivnost' radiolokatsionno-radiometricheskogo metoda distantsionnogo zondirovaniia pri obnaruzhenii i raspoznavanii neodnorodnostei podstlaiuschei poverkhnosti). A. K. ARAKELIAN, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 37, No. 9, Sept. 1992, pp. 1598-1605. 3 Refs. Documents available from Aeroplus Dispatch.

An algorithm is described that makes it possible to realize a simple method for the detection and recognition of underlying-surface inhomogeneities on the basis of a structural analysis of signals from radar-radiometric channels. The advantages of the radar-radiometric sounding method are shown.

A93-18326 Improvement of aircraft maintenance methods (Sovershenstvovanie metodov ekspluatatsii letatel'nykh apparatov). N. I. VLADIMIROV, Ed., (Rizhskii Inst. Inzhenerov Grazhdanskoi Aviatcii, Riga, Latvia). Riga, Rizhskii Institut Inzhenerov Grazhdanskoi Aviatcii, 1990, p. 155. Documents available from Aeroplus Dispatch.

The papers presented in this volume provide an overview of recent theoretical and experimental research aimed at improving the maintenance of aircraft, developing advanced diagnostic techniques, and increasing the efficiency and safety of flight operations. Topics discussed include design characteristics of the functional systems of aircraft and prediction of their technical condition, a probability analysis of a method for diagnosing gas turbine engines on the basis of thermogasdynamic parameters, characteristics of fatigue crack growth under the service-spectrum loading of the tail boom, and the accuracy of nonparametric reliability estimates under varying operation conditions. Papers are also presented on ways of reducing the aeration of hydraulic fluids in aircraft, evaluation of the efficiency of the pilot's control activity in a flight simulator, and using control charts for the analysis of the performance of aviation specialists.

A93-15191 Effect of the choice of the instability criterion in creep on the solution of the rod structure optimization problem (O vlianii

vybora kriteriia neustoichivosti pri polzuchesti na reshenie zadachi optimizatsii sterzhnevnykh konstruktii). M. N. KIRSANOV, *PMTF - Prikladnaia Mekhanika i Tekhnicheskaiia Fizika* (ISSN 0044-4626), No. 4, July-Aug. 1992, pp. 107-110. 12 Refs. Documents available from Aeroplus Dispatch.

The effect of the choice of the instability criterion on the solution of the rod structure optimization problem is evaluated with particular reference to conditional criteria. A solution is presented for the equation of the problem of maximum critical time for an arbitrary rod structure, and the minimum volume conditions is determined for a fixed critical time. It is shown that, in the first case, the choice of the criterion has no effect on the optimal structure shape; in the second case, the effect is only slight.

A92-53887 Application of the general problem of moments to some optimization problems in elasticity theory (O primenenii obshchei problemy momentov k nekotorym optimizatsionnym zadacham teorii uprugosti). E. I. GRIGOLIUK, V. A. FIL'SHTINSKII, and L. A. FIL'SHTINSKII, *Rossiiskaia Akademiia Nauk, Izvestiia, Mekhanika Tverdogo Tela* (ISSN 0572-3299), No. 2, March-April 1992, pp. 31-37. 9 Refs. Documents available from Aeroplus Dispatch.

Several optimization problems in elasticity theory are formulated which are relevant to geomechanics. Methods are then presented for reducing these problems to general moment problems in continuous-function space. By using polynomial approximations of nonstandard moment functions, the general moment problems are reduced to the classical power-law moment problem. This allows an a priori evaluation of the optimal control structure. Theoretical and computational examples are presented.

A94-21663 Efficiency of flight data utilization (Russian book) (Efektivnost' ispol'zovaniia poletnoj informatsii). I. V. KHAMRAKULOV, and B. V. ZUBKOV, Moscow, Izdatel'stvo Transport, 1991, p. 175. 43 Refs.

A methodology for developing and using software for ensuring flight safety is described which is based on a new approach to flight data utilization. In particular, attention is given to the principles of the organization and implementation of a flight data processing and analysis system, results of the development and use of computer-aided systems for the decoding and analysis of flight data, and statistical analysis of flight parameters from magnetic flight recorder data. The discussion also covers methods and algorithms for the numerical differentiation, smoothing, and estimation of flight trajectory parameters from magnetic flight recorder data; matching results of flight data measurements; and methods for determining the aerodynamic characteristics of controllability limits using flight data.

A94-11040 Optimal aerodynamic shapes in rarefied gas (Ob optimal'nykh aerodinamicheskikh formakh v razrezhenom gaze). R. N. MIROSHIN, Sankt-Peterburgskii Universitet, Vestnik, *Seriia 1 - Matematika, Mekhanika, Astronomiia* (ISSN 0024-0850), No. 1, Jan. 1993, pp. 77-82. 13 Refs. Documents available from Aeroplus Dispatch.

An isoperimetric problem concerned with the optimization of a convex body shape in rarefied gas is formulated. A two-stage procedure for solving the problem is presented. The solution is based on the theory of local interaction and employs the Chebyshev-Markov theorem.

A94-10942 Optimal body shapes with limits on local heat flux (Optimal'nye formy tel pri ogranichenii na lokal'nykh teplovoj potok). M. A. ARGUCHINTSEVA, and N. N. PILYUGIN, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 31, No. 3, June 1993, pp. 57-63. 10 Refs. Documents available from Aeroplus Dispatch.

The paper is concerned with the problem of determining optimal shapes of plane and axisymmetric bodies which would limit local heat overloads in addition to reducing the total (convective and radiative) heating of a body during the entry into a planet atmosphere. Examples of calculations of optimal body shapes and heat flow distributions over the body surface are presented. The aerodynamic and thermal characteristics of such bodies are compared with those of other bodies.

A93-52963 The combined effect of clearances and peripheral overlaps on the efficiency of microturbines with shroudless rotors (Sovmestnoe vliianie zazorov i periferiinoi perekryshi na ehfektivnost' mikro-turbin s rabochimi kolesami bez bandazha). B. A. KRYLOV, and S. A. GUSAROV, *Aviatsonnaya Tekhnika* (ISSN 0579-2975), No. 1, 1993, pp. 103-107. 8 Refs. Documents available from Aeroplus Dispatch.

Experimental data are presented on the combined effect of the upper overlap and of the axial and radial clearances on the efficiency of axial-flow microturbines with shroudless rotors. It is found that the effect of the upper overlap on the efficiency of microturbines with shroudless rotors is substantial and varies depending on the relative area of the radial clearance. Expressions are obtained for calculating the optimal upper overlap with allowance for the clearances.

A93-51909 Aerodynamic characteristics of airship models of different shapes (Aerodinamicheskie kharakteristiki modelej dirizhablej razlichnoi formy). A. N. KIRILLIN, and A. B. EGOROV, in *Problems in the aerodynamics of flight vehicles and their components* (A93-51901 22-02). Moscow, Russia, Moskovskii Aviatsonnyi Institut, 1992, pp. 48-53. 3 Refs. Documents available from Aeroplus Dispatch.

Results of wind tunnel tests are presented for ten airship models of different geometrical configurations. An analysis of the results demonstrates the advantages of the classical airship shape. Changing the aspect ratio from the traditional 5-6 to 3-4.5 is examined as a possible way of improving on the traditional airship geometry.