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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 Active Structures from Russia and Fatigue Life from Japan.

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 sponsorship and technical management of the abstract service by the Office of Naval Research (ONR) under ONR Grant N00014-93-I-1074.

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Russian Aerospace Literature This month: *Active Structures*

A95-23767 Construction of a cubic vector/spline for specifying the outlines of flight vehicles with singular points (Postroenie kubicheskogo vektor-splajna dlya zadaniya obvodov letatel'nykh apparatov s osobymi tochkami). A. I. OSOKIN and V. F. SNIGIREV (Kazanskij Gosudarstvennyj Tekhnicheskij Univ., Kazan, Russia), *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 3, 1994, pp. 86–91. In Russian. 3 Refs. Documents available from Aeroplus Dispatch.

A method is proposed for constructing a cubic vector/spline with parameterization which excludes singular points of the initial parametrization of the approximating line and boundary conditions. The application of such splines for approximating the outlines of flight vehicles is examined. Results of the approximation of the outline of the wing profile of a new aircraft design are presented which illustrate the efficiency of the numerical algorithm proposed here.

A94-22542 Black Shark Ka-50 combat helicopter. S. REZNICHENKO, *Military Parade*, Feb. 1994, pp. 8–13. In English and Russian. Documents available from Aeroplus Dispatch.

An account is given of the design features and performance capabilities of the Ka-50 assault helicopter, giving attention to its advanced weapons suite and capability for air-to-air as well as air-to-ground engagement. Composite materials make up 35 percent of the helicopter's primary structure; advanced armor is used to protect the pilot from direct hits of 20 mm shells to the cockpit.

A94-18476 Calculation, design, and construction of ultralight aircraft (Russian book) (Raschet, proektirovanie i postrojka sverkhlegkikh samoletov). P. I. CHUMAK and V. F. KRIVOKRYSENKO, Moscow, *Izdatel'stvo Patriot*, 1991, p. 240. In Russian. 36 Refs. Documents available from Aeroplus Dispatch.

The book is concerned with the various aspects of the analysis, design, and construction of ultralight aircraft of classical configurations. In particular, attention is given to determining the principal parameters and general design of ultralight aircraft, calculating the takeoff weight and the principal flight performance characteristics, fundamentals of the strength analysis of structural elements, and calculating and designing the main aircraft components. The discussion also covers the selection of the engine type and engine supercharging, various methods of propeller design, and manufacture of the airframe, wing, and propeller.

A94-10936 The need for an end face in the optimal rear section of a two-dimensional body in the presence of a boundary layer (O neobkhodimosti donnogo tortsa dlya optimal'noj kormovoj chasti dvumernogo tela pri nalichii pogranichnogo sloya). R. K. TAGIROV, *Rossijskaya Akademiya Nauk, Izvestiya, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), No. 4, July 1993, pp. 199–203. In Russian. 7 Refs. Documents available from Aeroplus Dispatch.

The effect of the boundary layer on flow past a body is examined with particular reference to supersonic flow past the rear section of a plane body. In the analysis, no constraints are imposed on the aspect ratio of the body. Results are presented for a rear section with and without an end face. It is shown that, in the presence of a boundary layer, an optimal rear section must always have an end face. Thus, for example, it is not necessary to have a sharp trailing edge between a nozzle and the rear section of the exhaust. It is noted that this conclusion is also valid in the case of subsonic flow.

A93-51905 Calculation of aerodynamic loads on the wing of rigid and elastic aircraft with allowance for load correction from experimental data (Raschet aehrodinamicheskikh nagruzok na krylo zhestkogo i uprugogo samoleta s uchetom korrektsii nagruzok ehksperimental'nymi dannymi). N. A. PODBOLOTOVA, In *Problems in the aerodynamics of flight vehicles and their components* (A93-51901 22-02). Moscow, Russia, Moskovskij Aviatsionnyj Institut, 1992, pp. 20–28. Documents available from Aeroplus Dispatch.

A method and software have been developed for calculating aerodynamic loads on aircraft during flight with allowance for the effects of static aeroelasticity. The software implements an iteration method for calculating aerodynamic loads on an elastic aircraft in subsonic flight. The aerodynamic computation scheme is based on the discrete vortex method. Details of the computation procedure and examples of calculations are presented.

A93-48901 Problems in the aerodynamics of flight vehicles and their parts (Voprosy aehrodinamiki letatel'nykh apparatov i ikh chastej). Y. A. RYZHOV, ed., *Moscow, Moskovskij Aviatsionnyj Institut*, 1991, p. 88 (For individual items see A93-48902–A93-49915). Documents available from Aeroplus Dispatch.

The book presents results of recent studies of certain aspects of the aerodynamics of flight vehicles and their components. In particular, attention is given to the aerodynamic characteristics of a sweptforward-wing aircraft model in unsteady motion at large angles of attack in subsonic flow, the use of triangular elements in panel methods for calculating flow past aircraft, and calculation of the turbulent viscosity coefficient. Papers are also presented on subsonic flow of a gas past an airfoil, effect of the wing planform on the optimal deformation of the middle surface, and pressure pulsation on a delta wing in incompressible flow.

A93-48825 Reliability and durability problems (Problemy nadezhnosti i dolgovechnosti). B. V. BOJTSOV and V. Z. KONDRASHOV (Moskovskij Aviatsionnyj Inst., Moscow, Russia), eds., Moscow, Moskovskij Aviatsionnyj Institut, 1992, p. 72 (No individual items are abstracted in this volume). Documents available from Aeroplus Dispatch.

The papers presented in this volume focus on methods for determining the stress-strain state of structures and machines and evaluating their reliability and service life. Specific topics discussed include a method for estimating the service life of thin-sheet automotive structures, stressed state at the tip of small cracks in anisotropic plates under biaxial tension, evaluation of the elastic-dissipative characteristics of joints by vibrational diagnostics methods, and calculation of the reliability of ceramic structures for arbitrary long-term loading programs. Papers are also presented on the effect of prior plastic deformation on fatigue damage kinetics, axisymmetric and local deformation of cylindrical parts during finishing-hardening treatments, and adhesion of polymers to diffusion coatings on steels.

A93-42370 Optimization of equipment layout in the fuselage of maneuverable aircraft (Optimizatsiya razmeshcheniya oborudovaniya v fyuzelyazhe manevrennogo samoleta). O. B. PASHCHENKO, In *Current methods of selecting the configurations and parameters of flight vehicles* (A93-42369 17-05). Moscow, Moskovskij Aviatsionnyj Institut, 1990, pp. 4–11. 4 Refs. Documents available from Aeroplus Dispatch.

A heuristic approach to the optimization of equipment layout in the fuselage of high-speed maneuverable aircraft is proposed which is based on formalized methods and techniques used in the design procedure. Based on a systematic analysis of the designer's activities, a semantic-information model of the design process is developed in the form of a generalized algorithm. The principal design constraints and criteria are discussed.

A93-42369 Current methods of selecting the configurations and parameters of flight vehicles (Sovremennye metody vybora skhem i parametrov LA). A. M. MATVEENKO, ed., Moscow, Moskovskij Aviatsionnyj Institut, 1990, p. 87 (For individual items see A93-42370–A93-42381). Documents available from Aeroplus Dispatch.

The papers presented in this volume are concerned with the methodological aspects of the design and development of aircraft. Topics discussed include optimization of equipment layout in the fuselage of maneuverable aircraft, selection of the primary aircraft structure at the preliminary design stage, and the structure of a knowledge base used in the computerized synthesis of aircraft layout. The discussion also covers formalization of problems in the preliminary design of aircraft, determination of the takeoff characteristics of jet engines during the preliminary design of aircraft, and selection of the turbofan engine size.

A93-36794 Load-bearing capacity of an aircraft wing based on the condition of compressed surface fracture (Nesushchaia sposobnost' kryla samoleta po usloviiu razrusheniia szhatoi poverkhnosti). V. F. GALKIN, In *Stress-strain analysis and optimal design of aircraft structures* (A93-36782 14-39). Moscow, Izdatel'skii Otdel TsAGI, 1992, pp. 105–110. In Russian. 3 Refs. Documents available from Aeroplus Dispatch.

A simple physically meaningful method is proposed which makes it possible to determine the fracture-causing bending moment in the cross section of a wing and the safety margin with sufficiently high accuracy without the use of a computer. The method is based on a fracture condition for a surface under compressive loading. The validity of the fracture criterion proposed here is demonstrated experimentally for an H-beam of D16T alloy. Calculations for a compressed wing section of V95pchT2 alloy are found to be in good agreement with static test results.

A93-36782 Stress-strain analysis and optimal design of aircraft structures (Raschety napriazhenno-deformirovannogo sostoianiia 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–A93-36800). In Russian. Documents available from Aeroplus Dispatch.

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.

A93-18375 Selection of the time scale for preventive measures under service conditions (Vybor vremennoi shkaly dlia provedeniia profilakticheskikh meropriiatii v usloviiakh ekspluatatsii). S. V. SHUL'ZHIK, In *Improvement of aircraft maintenance methods* (A93-18352 05-01). Riga, Rizhskii Institut Inzhenerov Grazhdanskoi Aviatsii, 1991, pp. 115–120. In Russian. 2 Refs. Documents available from Aeroplus Dispatch.

Several different time scales and their linear combination are considered for use as the basis for the preventive maintenance of aircraft systems. Based on results of fatigue testing, it is demonstrated that a linear combination of different time scales can be selected that would provide the most accurate estimates of reliability indices, thus minimizing economic losses due to the exhaustion of the assigned service life.

A93-18370 Crack growth under conditions of service loading (Rost treshchiny v usloviiakh ekspluatatsionnogo nagruzheniia). A. A. KONDRAT'EV, V. P. PAVELKO, and O. S. POPOV, In *Improvement of aircraft maintenance methods* (A93-18352 05-01). Riga, Rizhskii Institut Inzhenerov Grazhdanskoi Aviatsii, 1991, pp. 84–87. In Russian. 2 Refs. Documents available from Aeroplus Dispatch.

Data are presented on the conditions of a flight experiment aimed at the study of fracture toughness characteristics using crack growth indicators. Crack growth in a wing center section panel is considered as an example. Preliminary quantitative estimates of the parameters of a kinetic fracture diagram are obtained.

A93-18363 Improving the service characteristics of an aircraft through the gyroscopic damping of its structure (Uluchshenie ekspluatatsionnykh kharakteristik samoleta putem giroskopicheskogo vozdeistviia na ego konstruktsiiu). O. I. GAINUTDINOV and A. N. PROKOP'EV, In *Improvement of aircraft maintenance methods* (A93-18352 05-01). Riga, Rizhskii Institut Inzhenerov Grazhdanskoi Aviatsii, 1991, pp. 51–54. In Russian. 2 Refs. Documents available from Aeroplus Dispatch.

The gyroscopic damping of the aircraft structure in flight is examined as a method of protecting the on-board instrumentation and the crew against aeroelastic vibrations of the structure. An implementation of such gyroscopic damping system is described, and results of the use of the system on a hypothetical aircraft flying under conditions of atmospheric turbulence are discussed.

A93-10047 Determination of the membrane and flexural shell deformations from the readings of a two-sided rosette-type strain gage (Opredelenie membrannykh i izgibnykh deformatsii obolochki po pokazaniiam dvustoronnei rozetki). V. P. KOLOMIETS, In *Collection of works on measuring and computing systems for research on the aerodynamics, dynamics, and strength of flight vehicles* (A93-10026 01-35). Moscow, Tsentral'nyi Aerogidrodinamicheskii Institut, 1990, pp. 150–153. In Russian. 2 Refs. Documents available from Aeroplus Dispatch.

A simple and sufficiently general method is presented whereby the stress-strain moment state of a shell can be determined from the readings of a two-sided rosette-type strain gage. This method makes it possible to evaluate the nature and the possible direction of shell deformation at the site of the strain gage. The method is particularly suitable for thin-walled shells, which are commonly used in aircraft structures.

A92-53876 Aluminum-lithium alloys for welded aircraft structures (Aliuminievo-litievye splavy dlia svarnykh aviatsionnykh konstruktsii). I. N. FRIDLIANDER, A. G. BRATUKHIN, and V. G. DAVYDOV, *Metally* (ISSN 0568-5303), No. 3, May–June 1992, pp. 117–119. In Russian. Documents available from Aeroplus Dispatch.

The typical mechanical properties of sheets of aluminum-lithium alloy 1420 are presented, including ultimate tensile strength, yield strength, relative elongation, low-cycle fatigue characteristics, fatigue crack growth rate, and properties of welded joints. The melting, casting, and deformation process variables are examined. The advantages of using 14209 alloy in aircraft structures are demonstrated. In particular, it is shown that the use of a welded fuselage of 1420 alloy in the MIG-29 has made it possible to reduce the weight by 24 percent in comparison with a riveted fuselage of duralumin.