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Russian and Japanese Aerospace Literature

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Russian Aerospace Literature
This month: *Aircraft Control*

A93-52944 Solution of the boundary value problem in flight dynamics by the opposite motion method (Reshenie kraevoj zadachi dinamiki poleta metodom vstrechnykh dvizhenij). E. A. KRAMARENKO and O. G. KOVRIZHKIN, *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 1, 1993, pp. 30–34. 2 Refs.

A nonoptimization approach is proposed for solving the boundary value problem of guiding a flight vehicle to a specified terminal state on the basis of six phase coordinates. Control synthesis is carried out in steps using piecewise constant functions. The method is recommended for the generation of automatic control signals in guiding a flight vehicle to a specified point on the basis of six phase coordinates in relatively simple maneuvers.

A93-52942 A method for the spectral-time identification of the longitudinal and lateral motions of an aircraft (Metod spektral'no-vremennoj identifikatsii prodol'nogo i bokovogo dvizheniya samoleta). B. O. KACHANOV and K. B. KHROLOVICH, *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 1, 1993, pp. 22–26. 4 Refs.

A method for the identification of models of the longitudinal and lateral motions of an aircraft is proposed which combines the spectral and time approaches. The spectral approach makes it possible to reduce the identification procedure to a linear problem, while the time approach significantly improves the solution stability with respect to different kinds of measurement noise. Details of the identification procedure are discussed.

A93-52941 Stabilization of the dynamic characteristics of the two-channel automatic control system of aircraft (Stabilizatsiya dinamicheskikh khrakteristik dvukhkanal'noj sistemy avtomaticheskogo upravleniya samoleta). A. I. BOGOMOLOV and P. K. SEMENOV, *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 1, 1993, pp. 17–22. 5 Refs.

A method is proposed for ensuring the stability of the transient process characteristics in the automatic pilot-aircraft system with considerable crosstalk coupling between the control channels. The approach proposed here is an extension of the method proposed in an earlier study (Bogomolov and Semenov, 1992) for single-channel systems. The efficiency of the method is illustrated by an example.

A93-33383 Consideration of nonlinearities in the automatic control system in optimizing the aerodynamic configuration parameters of aircraft (Uchet nalichiia nelineinostei v SAU pri optimizatsii parametrov aerodinamicheskoi komponovki samoleta). IU. I. MAL'TSEV, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 39–43. 2 Refs.

An algorithm for considering the nonlinearity of an automatic control system when optimizing the aerodynamic stability of an aircraft is examined. The algorithm is based on the well-known method of multipliers, which is more computationally efficient than the harmonic linearization method. The principal features of the method are discussed. It is shown that the approach proposed here makes it possible not only to optimize the parameters of an aerodynamic configuration for a specified nonlinearity but also to formulate requirements of the nonlinear element in the automatic control system for the selected configuration parameters.

A93-50961 Prediction and planning of a flight vehicle route in the presence of motion inhibiting factors (Prognozirovanie i planirovanie marshruta dvizheniya letatel'nogo apparata pri nalichii faktorov protivodejstviya dvizheniyu). S. V. SHEBEKO, *Intelligent systems of flight-vehicle control* (A93-50951 21-63). Moscow, Moskovskij Aviatsionnyj Institut, 1991, pp. 59–64.

The paper is concerned with the problem of determining possible routes for a flight vehicle moving toward a specified point in the case where the characteristics of the terrain adjacent to this point are known. It is assumed that the terrain contains objects that may have a detrimental effect on the flight vehicle and prevent the achievement of the target. The negative effect of these objects on the flight vehicle is probabilistic. The approach proposed here is based on the simulation of human reasoning during the prediction and planning of a flight vehicle route.

A93-50954 Multilevel control systems and optimization of their structures (Mnogourovnevye sistemy upravleniya i optimizatsiya ikh struktur). A. A. BOGOLYUBOV and V. B. GALYUTIN, *Intelligent systems of flight-vehicle control* (A93-50951 21-63). Moscow, Moskovskij Aviatsionnyj Institut, 1991, pp. 17–25. 3 Refs.

The paper is concerned with the problem of selecting the optimal structure of a multilevel control system and formalizing the procedure of selecting the number of hierarchy levels. The formalization method is based on an aggregation- decomposition approach whereby a system is represented as a set of interconnected elements. The relations between the system elements are formalized using an alternative-graph method whereby the elements of the system are specified as graph apexes while the relations between the elements are shown by arcs. Methods of determining the complexity and controllability functions of a system are also discussed.

A93-50951 Intelligent systems of flight-vehicle control (Intellektual'nye sistemy upravleniya letatel'nykh apparatov). V. V., MALYSHEV, ED. Moscow, Moskovskij Aviatsionnyj Institut, 1991, 67 pp. (For individual items see A93-50952 to A93-50961).

The papers presented in this volume focus on the use of artificial intelligence in flight vehicle control, including the use of on-board expert systems to control flight safety in real time and accumulation of knowledge in the process of learning using pilot's experience. Papers are included on multilevel control systems and optimization of their structures, a target search system, prediction and planning of the flight vehicle route in the presence of motion inhibiting factors, and generation of a plant description dictionary based on expert survey data.

A93-39191 The problem of avoiding aircraft collisions during group flights (K zadache predotvrashcheniia stolknoveniia samoletov pri gruppovykh poletakh). S. E. ZELINSKII, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 4, 1992, pp. 66–68. 3 Refs.

An algorithm is proposed for generating a collision avoidance maneuver for the wingman aircraft in formation flights. The algorithm ensures collision avoidance while preserving the flight formation. Results of a computational experiment for Il-76 aircraft are presented as an illustration.

A93-50953 Definition of the structure of expert preferences for the multicriterial analysis of control systems (Vyyavlenie struktury predpochtenij ehksperta dlya mnogokriterial'nogo analiza upravlyayushchikh sistem). K. A. AFONIN and P. A. BOSIN, *Intelligent systems of flight-vehicle control* (A93-50951 21-63). Moscow, Moskovskij Aviatsionnyj Institut, 1991, pp. 12–17. 2 Refs.

The use of a multidimensional utility function (UF) as a generalized criterion for formalizing expert data is examined. The existing methods for obtaining the UF are briefly reviewed, and an approach to the derivation of multidimensional UFs is proposed which facilitates the formal definition of a system of expert preferences. The fundamental principles of the approach are discussed, and their implementation in an interactive system for the construction of multidimensional UFs is described.

A93-50952 Behavior of the particular quality characteristics of an intelligent flight vehicle control system in a multicriterial formulation (Povedenie chastnykh pokazatelej kachestva intellektual'noj sistemy upravleniya letatel'nym apparatom v mnogokriterial'noj postanovke). N. N. ANDRONOV, L. A. KOVZAN, G. N. LEBEDEV, and V. V. PODAFEJ, *Intelligent systems of flight-vehicle control* (A93-50951 21-63). Moscow, Moskovskij Aviatsionnyj Institut, 1991, pp. 4–12. 3 Refs.

The objective of the study was to develop a method for determining the dynamics of change of the weight coefficients of particular quality criteria using a multicriterial formulation. An approach is proposed whereby the Bellman equation, written for the case of alternative control, is replaced by a power- law polynomial in terms of phase coordinates. In addition to determining a general quality criterion, the development of a second feedback level in an artificial intelligence control system involves definition of the safe motion region and the development of an expert system which makes decisions on the basis of the acquired data using logic inference procedures.

A93-45662 Determination of the takeoff and landing characteristics of aircraft by using a conditional polar (Opredelenie vzletno-posadochnykh kharakteristik /VPKh/ samoleta s ispol'zovaniem uslovnoj polyary). YU. L. BYCHKOV, *Problems in the aerodynamics, strength, and flight operations of aircraft* (A93-45659 19-01). Moscow, Gosudarstvennyj NII Grazhdanskoj Aviatsii, 1991, pp. 10–13.

A method for constructing a conditional polar is presented whereby the engine thrust is used as a sufficiently reliable quantity in the analysis of the balance of forces acting on the aircraft. The thrust value is determined on the basis of certification tests, actual values of the engine parameters (rotation speed, fuel consumption, etc), and parameter changes with the altitude and velocity. The approach presented here has been applied to the processing of flight test data obtained for the Yak-42 aircraft.

A93-45660 Classification of the principal fuel saving methods in flight operations (Klassifikatsiya osnovnykh metodov ehkonomii aviatopliva v letnoj ehkspluatatsii). S. YU. SKRIPNICHENKO, *Problems in the aerodynamics, strength, and flight operations of aircraft* (A93-45659 19-01). Moscow, Gosudarstvennyj NII Grazhdanskoj Aviatsii, 1991, pp. 3–6.

Fuel saving methods in flight operations are classified into the following five general groups: pilot training, preflight and postflight preparatory work, fuel saving flight techniques, air traffic control, and technical preparation of aircraft. Specific methods within each group are examined.

A93-43831 Fundamentals of flight vehicle design (Russian book) (Osnovy ustrojstva i konstruirovaniya letatel'nykh apparatov). VLADIMIR N. NOVIKOV, BORIS M. AVKHIMOVICH, and VALERIJ E. VEJTIN, Moscow, Izdatel'stvo Mashinostroenie, 1991, 368 pp. 17 Refs. (ISBN 5-217-01299-4).

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 compex interaction with the environment, and solving problems arising the computer- aided design of flight vehicles.

A93-33390 A method for determining the functional dependences of the aerodynamic characteristics of aircraft from flight test results (Metodika opredeleniia funktsional'nykh zavisimostei aerodinamicheskikh kharakteristik samoleta po rezul'tatam letnykh ispytanii). A. V. CHERNYSHEV, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 73–79. 3 Refs.

The problem of determining the aerodynamic characteristics of aircraft from flight test results is formulated as that of reconstructing the function A(Y) from experimental data over the entire region of all the permissible values of the vector argument Y. A three-step procedure for determining the functional dependences of the aerodynamic characteristics of aircraft is presented. The method proposed here is illustrated by considering the problem of reconstructing the dependence of the lift coefficient on the angle of attack from quasi-experimental data obtained by the mathematical modeling of the perturbed longitudinal motion of an aircraft during a gliding descent.

A93-44508 Design of aircraft, helicopters, and aviation engines (Russian book) (Ustrojstvo samoletov, vertoletov i aviatsionnykh dvigatelej). KIM YA. ORLOV and VIKTOR A. PARKHIMOVICH, Moscow, Izdatel'stvo Transport, 1991, 224 pp. (ISBN 5-277-01192-7).

The history of aircraft engineering is briefly reviewed. Attention is given to the main structures of aircraft, powerplants, control systems, and navigation and radio electronic equipment of aircraft and helicopters. The discussion also covers the principal stages of aircraft manufacture, methods of ensuring the reliability and durability of structures, and characteristics and applications of fuels and lubricants.

A93-43079 Active algorithms for controlling the rotational motion of flight vehicles (Aktivnye algoritmy upravleniya vrashchatel'nymi dvizheniyami letatel'nykh apparatov). P. D. KRUT'KO, *Rossijskaya Akademiya Nauk, Doklady* (ISSN 0869-5652), Vol. 329, No. 2, March 1993, pp. 144–147. 4 Refs.

Algorithms with a unified structure are proposed for controlling the rotational motion of flight vehicles. The algorithms are synthesized by solving the problem of minimizing a functional characterizing the instantaneous value of the flight vehicle motion energy in the vicinity of a phase trajectory generated by a reference model. Algorithms synthesized in this way provide for a low system sensitivity to changes in the plant parameters. This is achieved without identification procedures, estimation of state coordinates, and self- tuning. The problem of aircraft motion control with respect to the yaw angle is considered as an example.

A93-39189 Optimization of the parameters of the lift-augmentation devices of the wing of a maneuverable aircraft equipped with an active load-reduction system (Optimizatsiia parametrov mekhanizatsii kryla manevrennogo samoleta, osnashchennogo aktivnoi sistemoi snizheniia nagruzok). V. P. SURIN and N. S. NIKOLAENKO, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), No. 4, 1992, pp. 59–62. 6 Refs.

The paper is concerned with the static problem of determining the parameters of the lift-augmentation devices of a maneuverable aircraft wing (the tailless scheme) equipped by an automatic load-reduction system. The problem of optimizing the parameters of the lift-augmentation devices is formulated as a mathematical programming problem. The solution of the problem is illustrated for a hypothetical tailless aircraft with a takeoff weight of 50,000 kg.

A93-39033 Absolute stability of an automatic control system for gas turbine engines (Absoliutnaia ustoichivost' sistemy avtomaticheskogo regulirovaniia GTD). N. P. SHUMSKII, *Dynamic processes in the powerplants and power-generating equipment of flight vehicles* (A93-39027 15-31). Kuibyshev, Russia, Kuibyshevskii Aviatsionnyi Institut, 1990, pp. 52–63. 11 Refs.

The paper is concerned with the absolute stability problem for nonlinear systems up to the fifth order inclusive in a plane of two generalized parameters. A simple method is developed for isolating a class of nonlinear systems in the general sense which are similar to stable linear systems. The analysis is based on stability criteria and diagrams developed by the author.

A93-39028 A study of the stability of the acceleration circuit of the hydromechanical automatic control system of an aviation gas turbine engine (Issledovanie ustoichivosti kontura priemistosti gidromekhanicheskoi SAU aviatsionnogo GTD). A. N. KRIUCHKOV and I. V. SHABUROV, *Dynamic processes in the powerplants and power-generating equipment of flight vehicles* (A93-39027 15-31). Kuibyshev, Russia, Kuibyshevskii Aviatsionnyi Institut, 1990, pp. 3–9. 3 Refs.

A nonlinear dynamic model is developed which describes the operation of the acceleration circuit of the automatic control system of an aviation gas turbine engine. The model allows for the nonlinearity of the circuit elements and for the presence of air bubbles in the system cavities. The stability of a system based on an analog computer is investigated, and recommendations are given concerning possible methods of enhancing the system stability.

A93-33391 Optimality of the linear control of trajectory motion (Ob optimal'nosti lineinogo upravleniia traektornym dvizheniem). I. M. SHARONOVA, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 79–83. 3 Refs.

In an earlier study (Pavlov and Sharonova, 1989), an algorithm was proposed for the synthesis of a linear law for trajectory motion control. Here, the applicability region of this law is illustrated by two examples. It is demonstrated that the linear control of trajectory motion is sufficiently close to optimal control over a wide range of altitudes.

A93-33380 An algorithm synthesis method for the lateral stability and controllability augmentation system of aircraft (Metod sinteza algoritmov sistemy uluchsheniia ustoichivosti i upravliaemosti bokovogo dvizheniia samoleta). IU. P. GUS'KOV, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 20–28. 3 Refs.

An approach to the augmentation of the lateral motion stability and controllability of aircraft is proposed which is based on the representation of equations of motion in semibound coordinates. New control parameters are introduced and defined. Procedures for the synthesis of isolated bank and yaw channels are described.

A93-39027 Dynamic processes in the powerplants and power-generating equipment of flight vehicles (Dinamicheskie protsessy v silovykh i energeticheskikh ustanovkakh letatel'nykh apparatov). V. P. SHORIN, V. V. BERDNIKOV, A. G. GIMADIEV, B. F. GLIKMAN, A. E. ZHUKOVSKII, A. F. MALEEV, and V. N., ORLOV, EDS. Kuibyshev, Russia, Kuibyshevskii Aviatsionnyi Institut, 1990, 145 pp. (For individual items see A93-39028 to A93-39043).

The papers presented in this volume deal with the experimental study and modeling of dynamic processes taking place in the pneumatic and hydraulic systems of powerplants, power generators, and control systems. In particular, attention is given to the control of the quality of dynamic processes in the valves of power-generating equipment, absolute stability of an automatic control system for gas turbine engines, and the required damping and control process quality in a fuel pressure regulator. Papers are also included on the modeling of the characteristics of small gas generators in continuous and pulsed operating modes, an approach to the modeling of dynamic processes in the powerplant of a spacecraft, and dynamic characteristics of a hydraulic servo drive.

A93-35676 Flight-vehicle drives (2nd revised and enlarged edition) (Russian book) (Elektroprivod letatel'nykh apparatov /2nd revised and enlarged edition/). VITALII A. POLKOVNIKOV, BORIS I. PETROV, BORIS N. POPOV, A. V. SERGEEV, A. N. SPERANSKII, Moscow, Izdatel'stvo Mashinostroenie, 1990, 352 pp. 24 Refs. (ISBN 5-217-00802-4).

The fundamentals of the theory and analysis of the electric servo systems of flight vehicles are discussed. The static, dynamic, and energy characteristics of servo systems with different types of actuating mechanisms (e.g., ac and dc motors, electromagnetic clutches, and mechanical variable-speed drives) are examined in relation to different methods of control; the limiting dynamic possibilities of servo systems are evaluated. Examples of different schemes of electric servo drives employing various types of actuating mechanisms and different control methods are presented.

A93-33387 Equations of aircraft motion in a perturbed atmosphere (K voprosu ob uravneniiakh dvizheniia samoleta v nespokoinoi atmosfere). S. A. PISAREVSKII, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 60–64. 3 Refs.

The flight of aircraft in a perturbed atmosphere is analyzed using approximate equations of motion in which the air velocity vector is determined in the same way as for no-wind conditions, and the velocity relative to the ground is represented as a sum of air velocity and wind velocity. This approach is valid for a constant-velocity wind but leads to an error when the wind velocity varies. An analysis of the magnitude of this error is presented.

A93-33386 A control law for aircraft turns (Zakon upravleniia razvorotom samoleta). K. A. PAVLOV and I. A. KIRDAN', *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 55–60. 5 Refs.

The paper is concerned with the formulation of a near-optimal control law for aircraft turns for implementation on an airborne digital computer. The control law developed here is based on an analysis of minimum-time turn trajectories. Some optimal turn trajectories based on the law proposed here are presented and compared with those based on the optimal control law.

A93-33385 Optimal input signals and output control functions for the identification of linear stationary models of the longitudinal and lateral motions of aircraft (Optimal'nye vkhodnye signaly i funktsii upravleniia vykhodami dlia identifikatsii lineinykh statsionarnykh modelei prodol'nogo i bokovogo dvizheniia samoletov). V. N. OVCHARENKO and V. P. BELIAEV, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 49–55. 2 Refs.

The problem of developing an optimal experimental design for plant identification in order to identify the unknown parameters with maximum accuracy and reliability within minimum time is formulated. The problem is solved by using algorithms for selecting the optimal input signals and output control functions of dynamic systems modeling the perturbed motion of aircraft. In the general case, the optimal control laws and output control functions are determined numerically using an iteration scheme. Efficient algorithms for this purpose have been developed and implemented in a set of software written in FORTRAN. Results of control optimization for the identification of the longitudinal motion parameters of a flying laboratory are examined as an example.

A93-33382 The ekranoplane as the controlled plant in automatic control systems (Ekranoplan kak ob'ekt upravleniia v SAU). A. M. MAKIENKO, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 33–39. 2 Refs.

The longitudinal perturbed motion of the ekranoplane is described by a system of dimensionless operator equations. Due to the presence of multiple-circuit relations between the ekranoplane motion channels, the use of the directional graph method is recommended for the structural analysis of the stabilization circuit and generation of the corresponding transfer functions. The main and auxiliary graphs for the longitudinal motion of the ekranoplane are constructed, and the structure of the flight stabilization circuit for longitudinal motion is derived.

A93-33388 Generation of perturbation signals in the problem of active identification of the parameters of linear mathematical models of aircraft motion (Formirovanie vozmushchaiushchikh signalov v zadache aktivnoi identifikatsii parametrov lineinykh matematicheskikh modelei dvizheniia LA). B. K. POPLAVSKII and G. N. SIROTKIN, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 64–70. 3 Refs.

A method is proposed for generating optimal perturbation signals sent to the controls when solving the problem of determining the coefficients of linear mathematical models of aircraft motion. In contrast to the known methods, which use the a priori values of mathematical model parameters, the method proposed here is based on the determination of an optimal linear combination of typical input test signals and responses generated during a test flight. The coefficients of the linear combination of typical signals are determined on the basis of an adopted optimality criterion.

A93-33381 A method for the experimental investigation of the possibility of occurrence of pilot-induced oscillations of a flight vehicle (Metodika eksperimental'nykh issledovanii vozmozhnosti vozniknoveniia kolebanii letatel'nogo apparata, indutsiruemykh letchikom). A. V. EFREMOV, A. V. OGLOBLIN, and A. V. KOSHELENKO, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 28–33.

Based on an analysis of the results of experimental studies of the aircraft- pilot system in problems of stabilization of the phase coordinates of flight vehicles, a method is proposed for investigating the pilot-induced oscillation (PIO) phenomenon using flight simulators and flying laboratories. The conditions maximizing the probability of PIO are defined, and a command signal is formulated which is capable of generating PIO in experimental investigations of this phenomenon. The method proposed here is illustrated by using the Space Shuttle as an example.

A93-33379 A systems approach to the development of a flight test program for aircraft (Sistemnyi podkhod k formirovaniiu programmy letnykh ispytanii LA). D. E. GRISHANKOV and N. A. KABANOV, *Analysis and synthesis of complex dynamic systems* (A93-33376 12- 08). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 15–20. 7 Refs.

The problem of the development of an efficient flight test program is separated into three component problems, each of which can be reduced to one of the known mathematical problems. The first problem consists of determining model structures and areas of their efficient application; the second problem consists of determining a set of flight tests required for the parametric identification of the models; the third problem involves the development of the test sequence and determining the required resources. The solution of the third problem is demonstrated for the case of the development of a test program required for the analysis of the stability and controllability characteristics of the TU-154 aircraft.

A93-33376 Analysis and synthesis of complex dynamic systems (Analiz i sintez slozhnykh dinamicheskikh sistem). M. N., KRASIL'SHCHIKOV, ED. Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, 87 pp. (For individual items see A93-33377 to A93-33391).

The papers presented in this volume focus on problems related to the stability and controllability of flight vehicles, synthesis of algorithms for stability and controllability augmentation systems, aircraft-pilot system, formulation of flight vehicle control laws, and determination of the aerodynamic characteristics of aircraft. Attention is also given to the problem of the optimal planning of flight vehicle tests, characteristics of an elastic aerostatic flight vehicle, and aircraft motion in a turbulent atmosphere.

A93-31211 Representation of functions for the synthesis of mechanisms used in aircraft control systems (Predstavlenie funktsii dlia sinteza mekhanizmov, primeniaemykh v sistemakh upravleniia samoletom). T. I. SOF'INA and N. G. BELIAKOVA, *Current problems in the dynamics and design of mechanisms and machines* (A93-31201 11-37). Moscow, Izdatel'stvo Moskovskogo Aviatsionnogo Instituta, 1991, pp. 43–50.

The problem of the reproduction of a specified function is considered in connection with the synthesis of mechanisms used in aircraft control systems, and an approach to the solution of the problem is presented. Based on the method proposed here, determinations are made of specified position functions reproducing linear, sinusoidal, tangential, and quadratic functional dependences, which are commonly used in the design of transmission gears.

A93-30252 Integration of aviation data transmission systems (Russian book) (Kompleksirovanie aviatsionnykh sistem peredachi informatsii). GEORGII A. KRYZHANOVSKII and MIKHAIL V. CHERNIAKOV, Moscow, Izdatel'stvo Transport, 1992, 296 pp. 135 Refs. (ISBN 5-277-00822-5.

The book is concerned with the possibility of increasing the level of flight safety through the integration of various kinds of air traffic control data. Methods for the optimal integrated processing of range, angle, and discrete data are presented, and the mathematical models used are described. Approaches to the integration of information and data display systems into automatic control systems, satellite systems, and collision prevention systems are reviewed.