Soviet and Japanese Aerospace Literature

Throughout 1988 the *AIAA Journal* will carry selected abstracts on leading research topics from the Soviet 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 Aircraft Navigation and Control Systems from the USSR and Aircraft Systems 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 N0014-87-6-0137.

Abstracts in this listing 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 online via DIALOG or NASA RECON.

Paper copies and microfiche of the original documents cited 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. Use the "A" number to identify material you want. Please be advised that most of the original documents are in the original language. Direct questions concerning this abstract section of the *AIAA Journal* to John Newbauer, AIAA Administrator, Technical Publications.

Soviet Aerospace Literature
This month: *Aircraft Navigation and Control Systems*

A88-49725   USSR - Future use of space and terrestrial radionavigation systems (U.R.S.S. - Utilisation future des systemes de radionavigation terrestres et spatiaux). G. MOSKVIN and V. SOROCHINSKII, *Navigation* (Paris) (ISSN 0028-1530), Vol. 36, July 1988, pp. 370-375.

Soviet ships engaged in international voyages are navigated using both Soviet navigation systems (Chaika and Tsikada) and foreign systems (Decca, Loran C, and Transit). The low-frequency phase modulation system Chaika is similar to Loran C. The Tsikada system consists of four to five satellites in quasi-circular orbit. Hybridization of the systems is considered. It is noted that present limitations either in coverage or in position-fixing accuracy and availability may be overcome by using the future Navstar and Glonass systems.

A88-50631   Search for and localization of reference fragments in the matching of repeated photographs (Poisk i lokalizatsiia repernykh fragmentov pri sovmeshchenii povtornykh snimkov). O. I. BITIUTSKII and G. I. PERETIAGIN, *Avtometriia* (ISSN 0320-7102), May-June 1988, pp. 78-84. 7 Refs.

A method is developed for estimating the relative-shift parameters of pairs of identical fragments on matched photographs. The estimates are based on the determination of the extremum of the response of the phase filter, having the form of the generalized convolution of the images being compared. The results obtained are of interest in connection with map-matching techniques for terminal guidance using Fourier phase information.

A88-44218   Estimation of the accuracy and reliability of navigation systems with allowance for course and coordinate corrections (K otsenke tochnosti i nadezhnosti navigatsionnykh sistem s uchetom korrektsii kursa i koordinat). A. A. RESSIN, A. D. TROIANOVSKII, and B. IA. TSIL'KER, *Priborostroenie* (ISSN 0021-3454), Vol. 31, May 1988, pp. 47-51. 9 Refs.

The physical situations leading to the frequently observed DE distribution of the lateral deviation are examined with particular reference to a practically important case which results naturally in such a distribution. Expressions for the probability density and dispersion of the lateral deviation of aircraft with respect to a given course line are obtained with allowance for occasional corrections of the course-indicating and dead reckoning systems.

A88-38429   Operating efficiency of an adaptive moving-target detector with allowance for variation of the sounding-pulse repetition period (Effektivnost' raboty adaptivnogo obnaruzhitelia dvizhushchikhsia ob'ektov s uchetom vobuliatsii perioda povtoreniia zondiruiushchikh impul'sov). A. V. AGRANOVSKII, A. A. ELISEEV, and A. V. POKROVSKII, *Radioelektronika* (ISSN 0021-3470), Vol. 31, April 1988, pp. 20-24.

The paper presents an analysis of the operating efficiency of an adaptive MTI system based on a tunable double alternating-period subtraction circuit for different typical correlation coefficients of noise fluctuations with allowance for the variation of the sounding-pulse repetition period. The results are of interest in connection with the use of circular-scan radars in air traffic control systems.

A88-43138   Architecture and organization principles of a multiprocessor complex-simulating computer system (Ob arkhitekture i printsipakh organizatsii mnogoprotsessornoi kompleksno-modeliruiushchei vychislitel'noi sistemy). OLEG NIKOLAEVICH P'IAVCHENKO, LIUD-MILA MIKHAILOVNA BLINOVA, and IGOR' FEODOS'EVICH SURZHENKO, *Elektronnoe Modelirovanie* (ISSN 0204-3572), Vol. 10, May-June, 1988, pp. 99-101.

The fundamental principles of the organization of multiprocessor computer systems with programmable architecture, distributed memory, and developed communication system for use in flight simulators and research stations operating in real time are examined. The principles discussed include the modular structure of hardware and software, heterogeneity and task-oriented design of processors, user-programmability of the system architecture, parallel-sequential organization of computational processes, memory distribution between modules, and hardware support of the functional levels of the system.

A88-39818   Minimax algorithms for the positional correction of inertial navigation systems (Minimaksnye algoritmy pozitsionnoi korrektsii inertsial'nykh navigatsionnykh sistem). A. I. MATASOV and S. R. MAR-TIROSIAN, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Tverdogo Tela* (ISSN 0572-3299), Mar.-Apr. 1988, pp. 4-14. 15 Refs.

The problem of obtaining minimax algorithms for the positional correction of inertial navigation systems is formulated as a problem of finding a generalized Chebyshev polynomial. A solution is constructed in an analytical form, and the question of the uniqueness of the optimal algorithms is examined.

A88-39571   Numerical comparison between an optimal guaranteed algorithm and a least squares algorithm (Chislennoe sravnenie optimal'nogo garantirovannogo algoritma s algoritmom metoda naimen'shikh kvadratov). A. A. GOLOVAN, S. R. MARTIROSIAN, and A. I. MATASOV, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 26, Mar.-Apr. 1988, pp. 319-322.

Estimates obtained with an optimal guaranteed algorithm are compared with those obtained with the least squares method for an example described by a fourth-order system of differential equations. The results are pertinent to the positional correction of inertial navigation systems.

A88-32776   Onboard solid-state active phased-array antennas (Bortovye tverdotel'nye aktivnye FAR /Obsor/). D. I. VOSKRESENSKII, V. L. GOSTIUKHIN, and K. G. KLIMACHEV, *Radioelektronika* (ISSN 0021-3470), Vol. 31, Feb. 1988, pp. 4-14. 26 Refs.

The main requirements on the energy, directional, polarization, and precision characteristics of active phased arrays in radio communications and radar systems are examined. Experimental results on active phased arrays under changing operating modes are presented, and aspects of the operation of active phased arrays in multifunctional radio systems are reviewed.

A88-28241   Effect of the random scatter of the parameters of antenna-system elements on the accuracy of the estimation of the coordinates of a point target and their derivatives (Vliianie sluchainogo razbrosa parametrov elementov antennoi sistemy na tochnost' otsenivaniia koordinat tochechnoi tseli i ikh proizvodnykh). G. S. NAKHMANSON, *Radioelektronika* (ISSN 0021-3470), Vol. 31, Jan. 1988, pp. 12-18. 6 Refs.

The paper examines the estimation of the location of a point target moving in the Fresnel zone of a multipositional antenna system (MAS) in the case of the coherent spatial-temporal processing of received broadband signals. The effect of the amplitude and phase characteristics of the MAS receiving elements on the accuracy of the estimation of the target coordinates and their derivatives is evaluated.

A88-33850   Estimation of the effect of navigation system precision and reliability on flight safety (K otsenke vliianiia tochnosti i nadezhnosti navigatsionnykh sistem na bezopasnost' poleta). A. A. RESSIN, A. D. TROIANOVSKII, and B. IA. TSIL'KER, *Priborostroenie* (ISSN 0021-3454), Vol. 31, March 1988, pp. 38-41. 8 Refs.

Approximate expressions are obtained for the probability density of the lateral deviation of aircraft from a given path with and without allowance for the memory of the dead reckoning system (inertial navigation system) and for the possible failure of the radio navigation system. Two kinds of initial distribution of lateral deviation in the case of inertial navigation system are considered: Gaussian and two-sided exponential distributions. The discussion is illustrated by an example.

A88-28865   The interaction of adjacent ATC automated systems. N. V. DAVYDOV and V. P. DENISHCHEV, *ICAO Bulletin*, Vol. 43, Jan. 1988, pp. 32-35.

The interaction protocol (the exchange of flight plan information) between adjacent ATC automated systems (ASs) is discussed. The ATC AS processing of messages coming from an adjacent systems consists of five steps: (1) message receipt; (2) queuing of the message; (3) retrieval of the flight plan according to defined criteria; (4) queuing of the message to the controller to whose working position the message was sent; and (5) message processing in accordance with the flight plan state. By providing the reaction of an adjacent ATC AS to a message transmitted, and by excluding possible misunderstandings of the actions of controllers in adjacent ATC ASs, the present protocol will increase controller efficiency and decrease controller error.

A88-24233   Short-range radio navigation systems - Current status and prospects. GEORGII A. PAKHOLKOV and GENNADII N. GROMOV, *IEEE Aerospace and Electronic Systems Magazine* (ISSN 0885-8985), Vol. 3, Jan. 1988, pp. 2-7.

Problems concerning the development of short-range navigation aids as integrated multifunctional systems for implementation in poorly equipped regions, on ice-breaker fleets, and on remote oil platforms are considered. Conclusions are drawn about the reasonability of utilizing for those purposes various modifications of existing integrated short-range navigation systems, such as the RSBN system in the USSR and the TACAN or VOR/DME systems in the western countries.

A88-43633   Principle of the design of the force scheme of multiple-support control surfaces (O printsipe proektirovaniia silovoi skhemy mnogoopornykh rulei). V. A. PAVLOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 1, 1988, pp. 110-112.

The use of three or more hinges in multiple-support control surfaces introduces statistical indeterminacy into the design of the force scheme of control surfaces. Here, methods of dealing with structural design problems associated with statistical indeterminacy of the force scheme of control surfaces are briefly examined. In particular, it is shown that the problem of the reduction of forces in the middle surface of a rudder and hinges can be solved by designing control surfaces with low flexural stiffness ratios. This condition can be achieved, for example, by using composite materials. A possible version of such a structure is described.

A88-43631   A study of the performance of a hydroacoustic filter in the lines of a flight vehicle (Issledovanie rabotosposobnosti gidroakusticheskogo fil'tra v magistraliakh letatel'nykh apparatov). IU. S. MIKHEEV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 1, 1988, pp. 106-108. 9 Refs.

Hydroacoustic filters with an insert having the shape of syiphon bellows have been developed in an attempt to reduce the filter weight and size, eliminate transmission of vibrations from tanks, and to achieve automatic tuning to the frequnecy of the wave being damped. Analytical expressions for the calculation of such filter are presented. To verify these expressions experimentally, they are applied to specially fabricated test filters with syiphons of Kh18N10T steel. The test filters have demonstrated good performance.

A88-17856   Trends in the improvement of gyroscopes and gyrostabilized platforms (Tendentsii sovershenstvovaniia giroskopov i girostabilizirovannykh platform). D. P. LUK'IANOV, L. A. SEVEROV, E. L. SMIRNOV, and A. V. TIL', *Priborostroenie* (ISSN 0021-3454), Vol. 30, Oct. 1987, pp. 46-56. 41 Refs.

The main trends in the improvement of the engineering and operating characteristics of gyroscopes and gyrostabilized platforms for use in inertial navigation systems are examined. The recent literature on the subject is briefly reviewed.

A88-11225   Structural methods for the expansion of the operating range of pendulum compensating accelerometers (Strukturnye metody rasshireniia rabochego diapazona maiatnikovykh kompensatsionnykh akselerometrov). A. G. BURIK, *Priborostroenie* (ISSN 0021-3454), Vol. 30, Aug. 1987, pp. 38-42. 11 Refs.

Structural methods for expanding the operating range of pendulum-type compensating accelerometers in the direction of low or high values are presented. In accordance with the methods presented here, the error is controlled on the basis of signal parameters, the operating point of the instrument is moved to the linear section of the characteristic, and dynamic stabilization of the operating point is achieved through astatic balancing. Examples of implementations of these methods are examined, and it is shown that the operating range of the existing instruments can be increased multifold without any decrease in accuracy.

A87-44312   Errors in the measurement of the course angles of radar reference points due to the imprecise stabilization of the antenna mounting in bank and pitch (Oshibki izmereniia kursovykh uglov radiolokatsionnykh orientirov iz-za netochnoi stabilizatsii osnovaniia antenny po krenu i tangazhu). S. D. SUBOCHEV, *Priborostroenie* (ISSN 0021-3454), Vol. 30, April 1987, pp. 49-52.

A first-approximation analysis is made of the measurement error of the course angle of radar reference points according to the indicator of an airborne panoramic radar. It is shown that the error depends linearly on the stabilization errors of the antenna mounting in bank and pitch.

A87-39263   Design concepts for CNS satellite systems (Communications, Navigation and Surveillance). V. P. KURANOV and Y. A. IOVENKO, *ICAO Bulletin*, Vol. 42, March 1987, pp. 22-24.

The use of a global satellite system for communications, navigation, and surveillance (CNS) is proposed. Such as system would assure access for all aircraft to all services, with relative simplicity and inexpensive onboard equipment. A CNS satellite system must consist of a network of instrumented artificial earth satellites, a ground-based complementary network for CNS and ATC, and aircraft avionic systems as required by the operators. The operations of automatic dependent surveillance and cooperative independent surveillance are discussed. Design configurations for a satellite navigation system, a communication system, and a surveillance system are presented and examined. (I.F.)

A86-52118   Analysis of asynchronous digital systems with digital coupling between computers (for aircrafts control) (Analiz asinkhronnykh tsifrovykh sistem s tsifrovymi sviaziami mezhdu vychisliteliami). IU. I. DIDENKO, *TsAGI, Uchenye Zapiski* (ISSN 0321-3429), Vol. 18, no. 6, 1987, pp. 51-59.

A method is presented for the analysis of the stability of reserved digital systems with asynchronously operating computers and digital transmission channels for data exchange between the reserved computers. Expressions for the characteristic equation of a reserved closed-loop system are obtained with allowance for the use of neighboring (reserved) computer signals in the control law. An analysis of the stability of an asynchronous digital flight control system is presented as an example.

A88-52103   Estimates of the precision of the automatic control of aircraft lateral motion during landing (Otsenki tochnosti avtomaticheskogo upravleniia bokovym dvizheniem samoleta pri posadke). V. P. KUZ'MIN, *TsAGI, Uchenye Zapiski* (ISSN 0321-3429), Vol. 18, no. 5, 1987, pp. 65-74. 6 Refs.

The problem of estimating the precision of automatic lateral motion control at the moment of touchdown is examined with allowance for the random nature of the landing distance. The aircraft motion is described by a linear system of differential equations. The probability distributions of various phase coordinates of the lateral motion are determined.

A88-52086 Determination of the coefficients in an algorithm for the control of the longitudinal motion of an aircraft during automatic landing, taking into account the limited efficiency of the control elements (Opredelenie koeffitsientov v algoritme upravleniia prodol'nym dvizheniem samoleta pri avtomaticheskoi posadke s uchetom ogranichennoi effektivnosti organov upravleniia). V. P. KUZ'MIN, TsAGI, Uchenye Zapiski (ISSN 0321-3429), Vol. 18, no. 4, 1987, pp. 65-73. 6 Refs.

A method and results of calculations are presented for choosing the parameters of algorithms of automatic aircraft landing with allowance for constraints on the maximum angle and maximum rate of elevator deviation. The determination of parameters in the control algorithm is based on an analysis of transient processes for linearized equations and on numerical calculations of the limiting deviations of the vertical velocity of aircraft landing.

A88-50772 Stability and controllability of aircraft in the operational region of flight conditions (Ustoichivost' i upravliaemost' samoleta v ekspluatatsionnoi oblasti rezhimov poleta). IURII IVANOVICH SNESHKO, Moscow, Izdatel'stvo Mashinostroenie, 1987, 136 pp. 21 Refs.

The stability and controllability characteristics of modern aircraft with various automatic pilot systems are briefly reviewed. In particular, attention is given to the forces and moments acting on aircraft during flight and their dependence on the flight parameters. Balancing curves are examined for longitudinal and lateral motion. Dynamic aircraft characteristics, such as frequency characteristics and transfer functions, are discussed.

A88-50767 Systems for the adaptive control of aircraft (Sistemy adaptivnogo upravleniia letatel'nymi apparatami). ANATOLII SEMENOVICH NOVOSELOV, VITALII EVGEN'EVICH BOLNOKIN, PETR IVANOVICH CHINAEV, and ARTUR NIKOLAEVICH IUR'EV, Moscow, Izdatel'stvo Mashinostroenie, 1987, 280 pp. 43 Refs.

Problems pertaining to the development of adaptive systems for the remote control of aircraft are considered. These include the adaptive selection of a control variant when the entire task is changed, an adaptive change in course, and the adaptation of individual subsystems and components. (K.K.)

A88-50766 Actuating devices of aircraft control systems (Ispolnitel'nye ustroistva sistem upravleniia letatel'nymi apparatami). BORIS GRIGOR'EVICH KRYMOV, LEV VLADIMIROVICH RABINOVICH, and VLADIMIR GRIGOR'EVICH STEBLETSOV, Moscow, Izdatel'stvo Mashinostroenie, 1987, 264 pp. 12 Refs.

The electrohydraulic, electropneumatic, and electrical actuating mechanisms of aircraft control systems are discussed. In particular, the principal requirements for the speed of response and load characteristics of drive mechanisms are examined; equations of motion describing the operation of control system drives are presented. The dynamic properties of the drives are investigated, and their transfer functions are determined. An analysis is made of the effect of load characteristics and saturation phenomena on drive dynamics. The dynamic characteristics of different types of steering drives are compared.

A88-48697 Systems of automatic aircraft control (2nd revised and enlarged edition) (Sistemy avtomaticheskogo upravleniia samoletom /2nd revised and enlarged edition/). IVAN ALEKSANDROVICH MIKHALEV, BARIT NIKOLAEVICH OKOEMOZ, and MANUIL SERGEEVICH CHIKULAEV, Moscow, Izdatel'stvo Mashinostroenie, 1987, 240 pp. 64 Refs.

This work describes parametric-optimization methods for application to automatic aircraft control systems. Particular consideration is given to an analysis of the mathematical model of the motion of an aircraft as a control plant; the fundamental principles underlying the design of automatic control systems for aircraft; the synthesis of stability and controllability automata structures; and the synthesis of structures for automatic stabilization and control in connection with pitch and bank. Particular consideration is given to an examination of longitudinal flying qualities.

A88-44901 Aircraft control mechanisms (Mekhanizmy upravleniia samoletom). VLADIMIR NIKOLAEVICH KESTEL'MAN and ANDREI VIKTOROVICH FEDOROV, Moscow, Izdatel'stvo Mashinostroenie, 1987, 184 pp. 85 Refs.

The book is concerned with the general principles of insuring the reliability and endurance of the parts and mechanisms of the aircraft control system. Criteria for estimating the performance of control mechanisms are presented, as are reference data on the structural materials and technological processes employed in the production of control system components. The fundamentals of the design of the individual parts of control mechanisms, such as gears, shafts, and bearing, are briefly discussed.

A88-41822 Powerplants with in-flight thrust vector deflection (Silovye ustanovki s povorotom vektora tiagi v polete). VIKTOR FEDOROVICH PAVLENKO, Moscow, Izdatel'stvo Mashinostroenie, 1987, 200 pp. 37 Refs.

Various types and schemes of powerplants with thrust vector deflection designed for VTOL, STOL, and STOVL aircraft and also for improving flight control characteristics are reviewed. The discussion includes the design and principle of operation of thrust vector deflecting devices and the aerogasdynamic effect of exhaust jets on the aircraft, powerplant, and

airfield pavement. The performance characteristics of powerplants with thrust vector deflection are presented.

A88-37699 Radio-electronic equipment of aircraft: Handbook (Radioelektronnoe oborudovanie letatel'nykh apparatov: Spravochnik). ANDREI ANAN'EVICH SOSNOVSKII and IZIDOR ARONOVICH KHAIMOVICH, Moscow, Izdatel'stvo Transport, 1987, 256 pp. 35 Refs.

The functions of the radio-electronic equipment of commercial aircraft, the factors determining the makeup of the equipment, and the principles of combining components in equipment complexes are discussed. Detailed data are presented on communication, navigation, landing, and traffic control systems and their components. Particular attention is given to the principle of operation, technical characteristics and parameters, architecture, and the overall design and layout of airborne radio-electronic systems.

A88-32746 Synthesis of a complex control system for gas turbine engines using orthogonal Legendre polynomials (Sintez kompleksnoi sistemy upravleniia GTD s ispol'zovaniem ortognal'nykh mnogochlenov lezhandra). IU. M. GUSEV, V. N. EFANOV, V. G. KRYMSKII, and N. F. KUL'NEVICH, Aviatsionnaia Tekhnika (ISSN 0579-2975), no. 3, 1987, pp. 79-81.

The paper is concerned with the problem of designing a complex controller capable of the coordinated control of all the principal transient and stationary processes associated with the operation of gas turbine engines. The control synthesis problem is solved by using a linear multimode engine model based on the linearization of the initial nonlinear engine models along the throttle (static) characteristic. To relate the model to the time characteristics of the control system, the time characteristics are expanded into a series in terms of orthogonal Legendre polynomials. The synthesis algorithm proposed here is illustrated by an example.

A88-29416 Fire prevention on civil aircraft (Protivpozharnaia zashchita samoletov grazhdanskoi aviatsii). VIKTOR KONSTANTINOVICH LUZHITSKII, Moscow, Izdatel'stvo Transport, 1987, 144 pp. 40 Refs.

Various aspects of fire prevention on civil aircraft are reviewed from the standpoint of flight safety assurance. In particular, the fire-hazard compartments of aircraft and the fire safety equipment and techniques used are examined. The principles governing the selection of fire safety techniques and equipment are reviewed, and typical schemes of fire alarm and fire extinguishing systems are presented. The discussion also covers the physicochemical mechanisms of combustion processes and fire extinction.

A88-29412 The first stage of flight testing of developmental test aircraft (Letnye ispytaniia pervykh opytnykh obraztsov samoletov), REFUL GERSHKOVICH IARMARKOV, Moscow, Izdatel'stvo Mashinostroenie, 1987, 144 pp. 32 Refs.

The goals of the initial stage of flight testing of developmental test aircraft are described. Particular consideration is given to the planning of flight tests during the aircraft design and construction period, the execution of the first flight test, ways to reduce the duration of the test-flight cycle, and typical defects and deficiencies encountered during the first stage of flight testing.

A88-29411 Statistical methods for evaluating the condition of aircraft equipment (Statisticheskie metody otsenki sostoianiia aviatsionnoi tekhniki). EVGENII IUR'EVICH BARZILOVICH and MAKSIM VASIL'EVICH SAVENKOV, Moscow, Izdatel'stvo Transport, 1987, 240 pp. 26 Refs.

The use of the methods of reliability theory and mathematical statistics in the analysis of data on the operation of aircraft equipment is discussed. In particular, a method is presented for the statistical verification of the aging hypothesis from data collected during aircraft operation. Statistical tests are presented for estimating the aging of aircraft system elements from the results of operational performance monitoring or failure data. The methods of the statistical analysis of the condition of aircraft systems proposed here are oriented toward computer processing of large amounts of data.

A88-27731 Cooling of airborne equipment (Okhlazhdenie bortovoi apparatury aviatsionnoi tekhniki). IGOR' VALENTINOVICH GLUSHITSKII, Moscow, Izdatel'stvo Mashinostroenie, 1987, 184 pp. 43 Refs.

Methods for the efficient cooling of airborne navigation, control, and communication equipment are presented which make it possible to maintain the electronic equipment at its normal working temperature under various service conditions. Engineering methods are proposed for solving thermophysical problems arising during the design of airborne electronic equipment, and experimental results are presented to demonstrate the validity of these methods. The cooling systems discussed include air, liquid, and evaporative systems.

A88-27727 Adaptive prediction flight control systems (Adaptivnye prognoziruiushchie sistemy upravleniia poletom). VALENTIN NIKOLAEVICH BYKOV, Moscow, Izdatel'stvo Nauka, 1987, 232 pp. 137 Refs.

Algorithms for the adaptive control of dynamic processes are considered which combine optimal control synthesis with the use of prediction models and real-time estimation of the controlled process parameters. The algorithms make it possible to allow, in a complete and natural manner, for both a priori and in-service information on the dynamic characteristics of

the system. Control of an essentially nonlinear process does not require model simplification. The adaptive prediction algorithms proposed here are not limited to problems of flight control and are applicable to most manufacturing processes, control of moving systems, and other problems.

A88-24792   Fiber-optic   gyroscope   (Volokonnyi   opticheskii giroskop). ALEKSEI GRIGOR'EVICH SHEREMET'EV, *Moscow, Izdatel'stvo Radio i Sviaz',* 1987, 152 pp. 57 Refs.

The principle of operation, general design, and performance characteristics of fiber-optic gyroscopes are discussed. Attention is given to the principal structural components of fiber-optic gyros, methods of compensation for noise and instabilities, direct dynamics effects, and the effect of an external magnetic field. Some specific experimental implementations of fiber-optic gyroscopes designed for different applications are examined.

A87-42128   Prediction of the reliability of aircraft part manufacturing processes (Diagnostika nadezhnosti tekhnologicheskikh protsessov izgotovleniia aviatsionnykh detalei). S. M. BOROVSKII and V. S. MUKHIN, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 1, 1987, pp. 13-16. 7 Refs.

The problem of predicting the reliability of aircraft part manufacturing processes is reduced to that of determining the probability that a manufactured part will satisfy the corresponding specifications with respect to a single generalized or differential parameter characterizing the quality of the surface layer. It is shown that the approach proposed here makes it possible to continuously refine the quality control of the surface layer using the accumulated experience of quality assurance.

A88-50715   Design features of fiber-optic communications systems and sensors (Osobennosti sozdaniia volokonno-opticheskikh sistem sviazi i datchikov). V. V. ABRAMOV, E. M. BAZARNYI, E. N. BAZAROV, V. V. GRIGOR'IANTS, IU. V. GULIAEV et al. *IN: Problems in contemporary radio engineering and electronics, Moscow, Izdatel'stvo Nauka,* 1987, pp. 104-118.

Research on fiber-optic communications systems and sensors carried out at the Institute of Radio Engineering and Electronics of the Soviet Academy of Sciences is reviewed. Particular attention is given to the use of electronic switching in the nodes or passive division of the fiber channels in distributed optical communications systems. Fiber-optic sensors of angular velocity, fluid refraction, temperature, and fluid level have been developed. The implementation features of these devices are examined.

A88-50575   High-latitude geophysical phenomena and the prediction of short-wave channels (Vysokoshirotnye geofizicheskie iavleniia i   prognozirovanie   korotkovolnovykh   radiokanalov). DONAT VLADIMIROVICH BLAGOVESHCHENSKII and GELII ALEKSANDROVICH ZHEREBTSOV, *Moscow, Izdatel'stvo Nauka,* 1987, 272 pp.

This book considers the specificity of distributions of decameter radiowaves at high latitudes and the possibility of predicting magnetospheric and ionospheric disturbances using short-wave radio channels. Models are presented for long-term and short-term (a few hours) predictions of the propagation of these disturbances. The effects of auroral substorms and global magnetic storms on the structure of propagating radio waves are examined. Empirical expressions are given which describe the relationships between various signal parameters, atmospheric radio noise, and geophysical effects. Recommendations for the selection of operating frequencies for various radio systems are presented.

A88-17858   Estimation of the accuracy of the identification of instrument errors of inertial navigation systems with additional rotation of the unit of sensitive elements (Otsenka tochnosti identifikatsii instrumental'nykh pogreshnostei inertsial'nykh navigatsionnykh sistem pri dopolnitel'nom vrashchenii bloka chuvstvitel'nykh elementov). A. V. REPNIKOV, V. A. TIKHONOV, and A. V. VAL'DOVSKII, *Priborostroenie* (ISSN 0021-3454), Vol. 30, Oct. 1987, pp. 62-67.

It is shown that the modulation of the instrument errors of an INS by harmonic functions with the rotation of the sensitive-element unit (SEU) makes it possible to obtain analytical expressions for solving covariation equations for the optimal-estimation errors. The accuracy and convergence rate of the estimation process can be controlled by changing the angular velocity of the additional rotation of the SEU.

A88-40304   Scalar estimation of multidimensional dynamic systems (Skaliarnoe otsenivanie mnogomernykh dinamicheskikh sistem). OLEG STEPANOVICH SALYCHEV, *Moscow, Izdatel'stvo Mashinostroenie,* 1987, 216 pp. 14 Refs.

The theory and methods for estimating multidimensional systems in scalar form are presented. In particular, attention is given to traditional methods of optimal estimation, scalar estimation and identification of multidimensional dynamic systems, wave representation of real perturbations in problems of the scalar estimation of multidimensional dynamic systems, and the use of scalar estimation algorithms for determining the errors of inertial navigation systems. The discussion also covers the initial orientation of inertial navigation systems using scalar estimation methods and scalar extrapolations of measured state vector components.

Japanese Aerospace Literature
This month: *Aircraft Systems*

A88-42074   Properties of coherent optical communication with received quantum state control and its capacity. OSAMU HIROTA, YOSHIHIRO YOSHIDA, MASAO NAKAGAWA, and MIKIO TAKAHARA, *Institute of Electronics, Information and Communication Engineers, Transactions* (ISSN 0913-574X), Vol. E71, April 1988, pp. 372-375. 17 Refs.

An attempt is made to counteract the transmission loss degradation of the advantages obtainable in optical communications by such nonstandard quantum states as the two-photon (or 'squeezed') state and the photon-number state. A clarification is presented of the properties of a coherent optical communication system employing a received quantum state controller; this proposed system is found to furnish noise-free operation, on the basis of its squeezer and phase-shift components' performance.

A88-50574   A digital adaptive flight control system design for aircraft with varying stability derivatives. YUZO SHIMADA, NOBUHIKO KOBAYASHI, and HIROAKI MIYAZAWA, *Japan Society for Aeronautical and Space Sciences Journal* (ISSN 0021-4663), Vol. 36, no. 413, 1988, pp. 304-311. 12 Refs.

The analytical derivation of an adaptive digital FCS for aircraft with continuously varying stability derivatives is outlined, and the performance of a prototype controller is demonstrated by means of numerical simulations of an advanced jet fighter. Existing controllers for linear time-varying systems are modified by introducing a parameter-adjustment algorithm which synthesizes the input to the aircraft from estimates of the dynamic-pressure power coefficients. The simulation results are presented in graphs, and the proposed controller is found to exhibit good adaptive capabilities.

A88-46049   Large motion robust flight control of aircraft by equivalent nonlinear elimination. SHOKICHI KANNO and TATSUO CHUBACHI, *Japan Society for Aeronautical and Space Sciences, Transactions* (ISSN 0549-3811), Vol. 31, May 1988, pp. 48-60. 7 Refs.

This paper is concerned with the large motion robust flight control of aircraft by the theory of approximate perfect servo and equivalent nonlinear elimination method. The perfect servo means that the transfer matrix is I(m), and the output, follows asymptotically any bounded arbitrary command inputs. The nonlinear dynamics of aircraft are equivalently eliminated by the equivalent elimination, and this operation does not need any numerical computation of aircraft dynamics. This system is robust and stable, being indifferent to the change of flight conditions and to the variation of aircraft dynamics. Simulations about a high speed aircraft showed very good results.

A88-46046   Synthesis of an adaptive flight controller under unknown deterministic disturbances. KIMIO KANAI, SHIGERU UCHIKADO, PETER N. NIKIFORUK, and NORIYUKI HORI, *Japan Society for Aeronautical and Space Sciences, Transactions* (ISSN 0549-3811), Vol. 31, May 1988, pp. 1-17. 12 Refs.

Two methods of designing an adaptive flight control system are developed using an algebraic polynomial method. The first is based on the direct control method, which identifies the plant parameters implicitly, and the second on the indirect method, which does this explicitly. The controllers which are designed using these schemes are able to take account of the uncertainties in the aircraft's stability and control derivatives, and are robust against the deterministic disturbances. Their application to the flight control of small, high-performance aircraft is examined using numerical simulations which show that the proposed schemes are effective.

A88-38344   Development of fiber optic data bus for aircraft. YUTAKA KOMOUCHI and AKIRA SUEOKA, *Mitsubishi Heavy Industries Technical Review* (ISSN 0026-6817), Vol. 25, Feb. 1988, pp. 57-60.

An account is given of the design, construction, and both ground and flight testing of a star-coupled fiber-optic data bus consisting of an optic coupler, fibers, a connector, and a transmitter/receiver. This system precludes spark/fire hazards and crosstalk problems, while offering very small size and weight for a given capability. The communication protocol for the data bus is of 1 Mbit/sec command response type, and its design attempted to minimize the effect on electronic interfaces as a result of conversion from electrical to fiber-optic buses.