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 Computer-Aided Design/Computer-Aided Manufacture from the USSR and Alloys in Structural Design from Japan.

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Soviet Aerospace Literature
This month: *Computer-Aided Design/Computer-Aided Manufacture*

A88-50777 Wing geometry: Methods and algorithms for designing lifting surfaces (Russian book) (Geometriia kryla: Metody i algoritmy proektirovaniia nesushchikh poverkhnostei). IURII VASIL'EVICH DAVYDOV and VIKTOR ALEKSANDROVICH ZLYGAREV, Moscow, *Izdatel'stvo Mashinostroenie,* 1987, 136 pp. 42 Refs.

Problems pertaining to the geometric simulation of aircraft wings are addressed. Methods for the mathematical description of planar contours and surfaces and for the calculation of geometric characteristics are presented. The formulation of algorithms for the solution of these tasks and the design of automated systems for their implementation are discussed.

A88-50666 High-performance FFT processors (Protsessory bystrogo preobrazovaniia Fur'e povyshennoi proizvoditel'nosti). T. N. FEDOROVSKAIA, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 33, July 1988, pp. 1481-1486. 7 Refs.

A modified FFT algorithm with a homogeneous structure is presented which makes it possible to organize computations with maximum performance using special-purpose processors. The designs of single-processor and multiprocessor devices implementing this algorithm are examined.

A88-50500 The construction and design of solid-propellant rocket engines (Russian book) (Konstruktsiia i proektirovanie raketnykh dvigatelei tverdogo topliva). IREK KHAIRULLOVICH FAKHRUTDINOV and ALEKSANDR VASIL'EVICH KOTEL'NIKOV, Moscow, *Izdatel'stvo Mashinostroenie,* 1987, 328 pp. 45 Refs.

Methods for assessing the durability of different components of solid-propellant rocket engines are presented. The following aspects of engine development are discussed: task formulation, parameter calculation, construction scheme selection, materials, and durability assessment.

A88-49507 Calculation of the mean mass temperature of the gas in the combustion zone of the combustion chamber of a gas turbine engine (Raschet srednemassovoi temperatury gaza v zone goreniia kamery sgoraniia GTD). S. G. DEMENKOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 2, 1988, pp. 25-29. 10 Refs.

A simple analytical method for calculating the mean mass temperature of a gas in a combustion chamber is proposed which uses an empirical expression relating the composition of the combustion products to the excess air and completeness-of-combustion coefficients. It is shown that the approach proposed here can be used at the stage of preliminary design calculations in CAD systems for gas turbine engine design.

A88-49502 Matrices of possible solutions for computerizing aircraft design with allowance for service requirements (Matritsy vozmozhnykh reshenii dlia avtomatizatsii proektirovaniia samoleta s uchetom ekspluatatsionnykh trebovanii). L. L. ANTSELIOVICH, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 2, 1988, pp. 7-11. 5 Refs.

A method for formalizing information on aircraft design solutions is proposed which makes it possible to improve the reliability, safety, and longevity of aircraft. The method helps select optimal design alternatives during the interactive computer-aided design process. The general design of a high-speed maneuverable aircraft is examined as an example.

A88-48323 A method for determining design contact pressures for moving chassis components on the basis of the specific friction force (Metod opredeleniia raschetnykh kontaktnykh davlenii dlia podvizhnykh uzlov shassi po predel'nomu znacheniiu udel'noi sily treniia). V. I. RIABKOV, I. N. VOLOKH, and N. G. TOLMACHEV, *Samoletostroenie - Tekhnika Vozdushnogo Flota* (ISSN 0581-4634), no. 54, 1987, pp. 94-98. 5 Refs.

A new approach to the calculation of contact pressures for the moving components of chassis and other aircraft mechanisms is developed on the basis of the experimental finding that the limiting value of the specific friction force is the determining factor in the failure of the moving surfaces of friction pairs in aircraft components. The method proposed here makes it possible to obtain, early in the design process, reliable estimates of the contact pressures that would guarantee the required load-bearing capacity of the moving components and minimize their mass.

A88-48301 Computer analysis of the effect of the location of the vertical tail surface on the static lateral stability of a tailless aircraft (Issledovanie na EVM vliianiia polozheniia vertikal'nogo opereniia na staticheskuiu bokovuiu ustoichivost' letatel'nykh apparatov tipa 'beskhvostka'). E. D. KOVALEV and M. M. OVCHAROV, *Samoletostroenie - Tekhnika Vozdushnogo Flota* (ISSN 0581-4634), no. 54, 1987, pp. 3-5.

A mathematical model is developed for investigating the influence of the location of the vertical tail surface on the static lateral stability of a tailless aircraft in the case of separated flow past the delta-wing leading edges. It is shown that, as the wing aspect ratio increases, intense vortex filaments are formed which have a powerful effect on the flow past the vertical tail surface. Calculations are compared with experimental data.

A88-46062 Design of aircraft structures (Russian book) (Proektirovanie konstruktsii samoletov). ELENA SERGEEVNA VOIT, ASKOL'D IVANOVICH ENDOGUR, ZAVEN ASHOTOVICH MELIK-SARKISIAN, and IGOR' MIKHAILOVICH ALIAVDIN, Moscow, *Izdatel'stvo Mashinostroenie,* 1987, 416 pp. 24 Refs.

This work elaborates the principles underlying the design of aircraft structural components (wings, fuselages, tail assemblies, etc.) and considers methods for assuring structural stability with minimum weight. Al-

gorithms for the design of junctions between components are examined, and requirements on the total structural design of an aircraft are presented along with criteria for the optimization of design solutions. The role of fabrication processes and the materials used in the choice of design is considered.

A88-43618 Boundary conditions for splines in the problem of the computer-aided design of bypasses (Kraevye usloviia splaina dlia zadachi avtomatizatsii proektirovaniia obvodov). V. F. SNIGIREV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 1, 1988, pp. 75-77.

Procedures for constructing cubic splines are examined which do not require the explicit specification of boundary conditions. This is achieved by using Hermite's interpolation polynomials of fourth degree in the boundary regions of the splines. The method proposed here is compared with other methods of spline construction; results of numerical experiments are presented.

A88-43602 A set of applied programs for solving nomographic approximation problems in design studies of working processes in flight vehicle engines (Paket prikladnykh programm SANA dlia resheniia zadach nomograficheskoi approksimatsii pri proektnykh issledovaniiakh rabochikh protsesov v DLA). V. E. ALEMASOV, E. A. DAUTOV, A. F. DREGALIN, and M. L. SERGIEVSKAIA, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 1, 1988, pp. 8-12. 10 Refs.

A set of application software has been developed for solving problems associated with the multidimensional approximation of tabulated data in the development of computer-aided design systems. Examples of nomograms and analytical expressions based on them which can be useful in the computer-aided design of flight vehicle engines are presented. A diagram of a system for the computer-aided design of nomograms is included.

A88-41813 Nonstationary problems of contact and conjugate heat transfer in plasma processes (Nestatsionarnye zadachi kontaktnogo i sopriazhennogo teploobmena v plazmennykh tekhnologiiakh). O. P. SOLONENKO and A. I. FEDORCHENKO, *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskie Nauki* (ISSN 0002-3434), April 1988, pp. 76-87. 16 Refs.

The paper is concerned with some problems of contact and conjugate heat transfer that are considered to be important from the standpoint of the practical implementation of CAD/CAM systems for processes based on plasma technology, such as deposition of plasma-sprayed coatings and plasma treatments. In particular, attention is given to the thermohydrodynamics of the interaction between a melted particle and a surface and the thermal state of a hollow cathode with a split contracted arc. Exact and approximate solutions to the heat transfer problems considered here are presented.

A88-40841 Representation of the effect of anticorrosion coatings and environments in the fatigue curve equations of aluminum materials (Otobrazhenie vliianiia protivokorrozionnykh pokrytii i vneshnikh sred v uravneniiakh krivykh ustalosti aliuminievykh materialov). L. N. KOSINSKAIA, *Fiziko-Khimicheskaia Mekhanika Materialov* (ISSN 0430-6252), Vol. 24, Mar.-Apr. 1988, pp. 66-69. 6 Refs.

A fatigue curve equation for materials with anodic coatings is obtained in the form of a hierarchical block structure. The equation contains, in explicit form, information on the fatigue behavior of the material in air, its fatigue strength for a base of 10 to the 7th cycles, softening and hardening effects of the coating for different test bases, and environmental effects. Each part of these data can be isolated and used for simulations and calculations in CAD systems.

A88-36021 A Doppler velocimeter based on an iodine laser for explosion-accelerated targets (Doplerovskii izmeritel' skorosti mishenei, uskoriaemykh vzryvom, na osnove iodnogo lazera). G. B. VLASOVA, A. L. MIKHAILOV, B. A. POKLONTSEV, and A. V. FEDOROV, *Fizika Goreniia i Vzryva* (ISSN 0430-6228), Vol. 24, Jan.-Feb. 1988, pp. 127-130. 6 Refs.

A laser Doppler velocimeter based on an iodine laser and Fabry-Perot interferometer has been designed for measuring the velocity of explosion-accelerated bodies. The general design of the device is described and its optical scheme is presented. The laser Doppler velocimeter described here makes it possible to measure the velocities of surfaces, including diffuse-scattering surfaces, with an accuracy to within 10 m/s.

A88-33956 Prospects in the development of high-energy-capacity flywheels for spacecraft power systems (Perspektivnye napravleniia v razrabotke vysokoenergoemkikh makhovikov dlia energosistem kosmicheskikh letatel'nykh apparatov). V. S. BUDNIK, N. F. SVIRIDENKO, and V. I. KUZNETSOV, *Kosmicheskaia Nauka i Tekhnika* (ISSN 0321-4508), no. 1, 1986, pp. 52-57.

The structural and power design of superflywheels for spacecraft power systems is described. Particular attention is given to the following designs: flywheels with radial orientation of energy-storage elements, composite quasi-isotropic disks, and multirim flywheels. The energy-storage characteristics of these devices are analyzed, and the development of efficient high-energy-capacity flywheel constructions is discussed.

A88-33807 Robot engineering and flexible production systems (Russian book) (Robototekhnika i gibkie proizvodstvennye sistemy). EVGENII PAVLOVICH POPOV, Moscow, *Izdatel'stvo Nauka,* 1987, 192 pp. 68 Refs.

Various aspects of the use of industrial robots and manipulators in manufacture are discussed in a popular manner. In particular, attention is given to the general design and characteristics of industrial robots, the social and psychological aspects of the use of robots, programmed control of robots, adaptive robots, and artificial vision systems for robots. The discussion also covers computer-aided design of robot control systems, software support of adaptive robot systems, and the current status and evolution of flexible production.

A88-32756 Computer-aided design of the electrical systems of aircraft (Ob avtomatizirovannom proektirovanii elektricheskikh sistem bortovogo oborudovaniia samoletov). V. S. TERESHCHUK, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 3, 1987, pp. 102-104. 6 Refs.

The general principles governing the development of CAD systems for the design of airborne electrical equipment, an implementation of the first stage of such a CAD system, and the design of an electric power distribution system are briefly reviewed. The discussion covers the general architecture of the CAD system for airborne electrical equipment, the main modules of the system, software support, and a description of an iterative design procedure for power distribution systems.

A88-29433 Biocybernetic optoelectronic devices of automated image recognition (Russian book) (Biokiberneticheskie optiko-elektronnye ustroistva avtomaticheskogo raspoznavaniia izobrazhenii). VIKTOR L'VOVICH LEVSHIN, Moscow, *Izdatel'stvo Mashinostroenie,* 1987, 176 pp. 147 Refs.

This work examines theoretical and engineering aspects of the development of optoelectronic systems for the detection, recognition, and tracking of objects observed from flight vehicles. Systems based on concepts of bionics and cybernetics are considered. Particular emphasis is placed on the structure, operation, and simulation of the visual systems of animals and humans as well as on the theory of object recognition according to two-dimensional images. The design of automated real-time image-processing devices is considered along with the development of adaptive learning systems.

A88-29413 Computer-aided study of parachutes and ultralight aircraft (Russian book) (Issledovanie parashiutov i del'taplanov na EVM). SERGEI MIKHAILOVICH BELOTSERKOVSKII, MIKHAIL IVANOVICH NISHT, ANATOLII TIMOFEEVICH PONOMAREV, and OLEG VLADIMIROVICH RYSEV, Moscow, *Izdatel'stvo Mashinostroenie,* 1987, 240 pp. 79 Refs.

The book deals with the use of mathematical modeling and computer simulations in the analysis of the aerodynamic, elastic, and aeroelastic characteristics of parachutes and ultralight aircraft. In particular, attention is given to the general design, operation, and performance characteristics of parachutes and ultralight aircraft, the role of numerical experiments in studies of parachutes and ultralight aircraft, aerodynamic and elastic models of axisymmetric and nonaxisymmetric parachutes and ultralight aircraft, and numerical methods of stress-strain analysis. The discussion also covers motion analysis and principal problems in the aeroelasticity and flight dynamics of parachutes and ultralight aircraft.

A88-27746 Proceedings of the 11th Polish Conference on the Theory of Machines and Mechanisms, Zakopane, Poland, Apr. 27-30, 1987, *Politechnika Slaska, Zeszyty Naukowe, Mechanika* (ISSN 0434-0817), no. 85-86, 1987, no. 85–334 pp.; no. 86–464 pp.

The conference presents papers on the diagnostic classification of machinery conditions and their interpretation, the detection of parameter changes in a mechanical nonlinear rotational system, microcomputer-aided teaching of the fundamentals of machine steering, the basic functions of expert systems, and the basic requirements of a CAD system for designing robotized stands. Consideration is also given to the determination of the position function in link mechanisms, the application of the finite element method to the study of the human skeletal system, and a method of suboptimal decentralized control in robotics. Other topics include the principles and techniques of pragmatic simulation, polyoptimal synthesis, and bending vibrations of a shaft with thin disks.

A88-27738 Theory and analysis of solid-propellant rocket engines (Russian book) (Teoriia i raschet raketnykh dvigatelei tverdogo topliva). DANIIL ISAAKOVICH ABUGOV and VLADIMIR MIKHAILOVICH BOBYLEV, Moscow, *Izdatel'stvo Mashinostroenie,* 1987, 272 pp. 25 Refs.

The book presents the fundamentals of the theory and analysis of solid-propellant rockets. In particular, attention is given to the general characteristics of solid-propellant rocket engines, the main types of solid rocket propellants, combustion processes in solid-propellant engines, calculation of the gasdynamic parameters of solid-rpopellant rocket engines, and flow of combustion products in the nozzles of solid-propellant rocket engines. The discussion also covers instability of solid-propellant engines, heat transfer and heat protection, combined engines, and computer-aided design of solid-propellant rocket engines.

A88-26232 Fourier, Mellin, and Galerkin integral transforms in automatic system synthesis methods (Integral'nye preobrazovaniia Fur'e, Mellina i Galerkina v metodakh sinteza avtomaticheskikh sistem). I. A. ORUK, *Avtomatika i Telemekhanika* (ISSN 0005-2310), Nov. 1987, pp. 55-60. 6 Refs.

Two computationally efficient machine-oriented methods for the optimal synthesis of continuous automatic systems with regular signals are examined. These methods are the method of similarity of generalized frequency characteristics and the extension of variational analysis to synthesis and optimization problems. For linear and linearized systems, the two approaches are shown to be computationally identical.

A88-25638 Representation of fan characteristics in a mathematical model of the bypass engine (Predstavlenie kharakteristiki ventiliatora s matematicheskoi modeli). B. D. TRDD FISHBEIN and V. I. TIKHONOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 4, 1987, pp. 95–96.

The problems associated with the representation of fan characteristics in the mathematical modeling of bypass engines are briefly examined, and a form of representation is proposed which provides an adequate description of the modeled system in a wide variety of design problems, particularly with the introduction of computer-aided design. The representation of fan characteristics proposed here applies, in particular, to a fan design with common exit guide vanes and a separator shifted downstream.

A88-24791 Fundamentals of the synthesis of flight vehicle systems (Russian book) (Osnovy sinteza sistem letatel'nykh apparatov). ALEKSANDR ALEKSANDROVICH LEBEDEV, VIASCHESLAV NIKOLAEVICH BARANOV, VLADIMIR TIMOFEEVICH BOBRONNIKOV, MIKHAIL NAUMOVICH KRASIL'SHCHIKOV, VENIAMIN VASIL'EVICH MALYSHEV et al. Moscow, *Izdatel'stvo Mashinostroenie,* 1987, 224 pp. 75 Refs.

The book is concerned with the methodology of the analysis and synthesis of complex technical systems containing flight vehicles as their main components. Topics discussed include the main concepts of systems engineering, statement of system synthesis problems and selection of efficiency criteria, methodological aspects of the development of models for system synthesis, optimization methods, and computer analysis of models. The synthesis of a metereological space system is examined as an example.

A88-24750 Optimization of low-thrust transfers in space: Aspects of trajectory and angular-motion control (Russian book) (Optimizatsiia kosmicheskikh pereletov s maloi tiagoi: Problemy sovmestnogo upravleniia traektornym i uglovym dvizheniem). VADIM VIKTOROVICH SALMIN, Moscow, *Izdatel'stvo Mashinostroenie,* 1987, 208 pp. 94 Refs.

This book examines the optimal control of the trajectory and angular motion of spacecraft with low-thrust electrojet engines for interorbital and interplanetary transfers. The motion control of spacecraft with a combined propulsion system consisting of high-thrust and low-thrust engines is considered. Attention is also given to optimal low-thrust transfers betwen circular noncoplanar orbits; optimal low-thrust transfers between the coplanar elliptical orbits of earth satellites; and the optimization of multistep interorbital transfers.

A88-19578 An approach to the multicriterial optimization of composite shells under stochastic loading (Ob odnom podkhode k mnogokriterial'noi optimizatsii kompozitnykh obolochek pri stokhasticheskikh nagruzkakh). N. F. MORMUL' and IU. M. POCHTMAN, *Dinamika i Prochnost' Mashin* (ISSN 0419-1544), no. 43, 1986, pp. 76-80.

The problem of the multifactorial optimum design of composite cylindrical shells is analyzed for the case of loading by a random axial compressive force. The weight of the structure and its reliability are used as the quality criteria. Reliability estimates are obtained by using the formalism of random field overshoot theory; the multicriterial problem is solved using interactive computer algorithms. Optimum shell designs are discussed.

A88-19360 Robot engineering and flexible CAM systems. Volume 5 - Simulation of robot-engineering systems and flexible CAM systems (Russian book) (Robototekhnika i gibkie avtomatizirovannye proizvodstva. Volume 5 - Modelirovanie robototekhnicheskikh sistem i gibkikh avtomatizirovannykh proizvodstv). STANISLAV VASIL'EVICH PANTIUSHIN, VIKTOR MIKHAILOVICH NAZARETOV, OLEG ARKAD'EVICH TIAGUNOV, VIKTOR PANTELEIMONOVICH KHAIDUKOV, ANDREI VLADIMIROVICH KUL'BA et al. Moscow, *Izdatel'stvo Vysshaia Shkola,* 1986, 176 pp. 16 Refs.

This book examines kinematic and dynamic models of manipulators of arbitrary structure, methods for the computer analysis of manipulator motion, and software for the manipulator simulation. Attention is also given to simulation principles for flexible-CAM systems, models of flexible-CAM components, and hardware and software facilities for the implementation of the simulation.

A88-18084 Principles of the development of thermally sprayed coatings of composite powders (Printsipy sozdaniia gazotermicheskikh pokrytii iz kompozitsionnykh poroshkov). IU. S. BORISOV and A. L. BORISOVA, *Zashchitnye Pokrytiia na Metallakh* (ISSN 0130-1519), no. 20, 1986, pp. 20-24. 7 Refs.

An approach to the development of thermally sprayed composite coatings is presented which uses generalized charts describing the effect of various factors on the coating properties and a morphological matrix table. The main stages of the coating design procedure are defined and briefly characterized. The approach presented here can be used in a computer-aided process design system for the development of thermally sprayed coatings.

A88-16216 An optimum parametric series formulation of multifunctional carriers for space systems using economic criterion. V. N. NOVIKOV, I. S. GOLUBEV, and V. V. STROKOV, *38th IAF International Astronautical Congress,* Brighton, England, Oct. 10-17, 1987. 11 pp. (IAF Paper 87-623).

A technique is presented for formulating an optimum parametric series of carriers and booster units for multifunctional space vehicles in a wide range of orbits and orbital payloads. The technique is based on a systems, multilevel, alternative, and criterion approach with feed forward and feedback relations at every level. A solution of the general problem can be treated as a set of optimizational and combinatorial problems based on the given material resources providing maximum efficiency of realization.

A88-15677 The efficiency optimization of ballistic missiles (Russian book) (Optimizatsiia parametrov ballisticheskikh raket po effektivnosti). ALEKSANDR ALEKSEEVICH KUZNETSOV, Moscow, *Izdatel'stvo Mashinostroenie,* 1986, 160 pp. 28 Refs.

The work develops the methdology underlying the use of computers to calculate the optimal parameters of ballistic missiles at the design proposal stage. Efficiency is considered as the scientific foundation of the computer-aided design of ballistic missiles. The mathematical foundations of parametric design are examined; and the proposed approach is illustrated by a FORTRAN-IV program for calculating the optimal design parameters of ballistic missiles.

A88-12171 The use of lasers to manufacture electronic equipment (Primenenie lazerov v tekhnologii izdelii elektronnoi tekhniki). G. M. ZVEREV, *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia* (ISSN 0367-6765), Vol. 51, Aug. 1987, pp. 1399-1403. 21 Refs.

The development of an automated laser engraving system for the production of printed circuits is described; the system uses a Q-switched YAG laser operating at a wavelength of 1.06 micron. The implementation of CAD/CAM systems on the basis of laser technology and microprocessor control is examined. In addition, the use of an XeCl excimer laser to form diffusion junctions with a depth from 50 to 120 nm is discussed.

A87-53957 Principles of the computer-aided design of aircraft (Russian book) (Osnovy avtomatizirovannogo proektirovaniia samoletov). SERGEI MIKHAILOVICH EGER, NIKOLAI KONSTANTINOVICH LISEITSEV, and OLEG SERGEEVICH SAMOILOVICH, Moscow, *Izdatel'stvo Mashinostroenie,* 1986, 232 pp. 34 Refs.

The fundamentals of the computer-aided design of aircraft and some specific problems associated with the use of CAD systems are examined. The discussion covers the objectives and functions of CAD systems in aircraft design, software support of CAD systems, principal design procedures, methods of design optimization, characteristics of the design of multipurpose aircraft. Particular attention is given to the computer-aided design of the general aircraft layout and load-bearing structures. The principal modules of a CAD system for aircraft design are described.

A87-49718 Structural synthesis of semiconductor devices (Strukturnyi sintez poluprovodnikovykh priborov). E. L. GLORIOZOV, O. M. ORLOV, and M. V. TSAREV, *Radioelektronika* (ISSN 0021-3470), Vol. 30, June 1987, pp. 24-30.

An algorithm for generating new semiconductor devices is formulated. Knowledge about the device is represented in the form of three files which contain information about the physical properties of the material layers; this knowledge is formalized as a graph of a digital computing system. It is shown that strict formal rules can be used to obtain any engineering solution (any semiconductor device) from this computing system. The appropriate operator and effectiveness-function concepts are introduced, and the structural-synthesis problem is formulated as an integer combinatorial problem.

A87-49716 Intelligent CAD systems (Inteliektualizatsiia SAPR). V. N. IL'IN, *Radioelektronika* (ISSN 0021-3470), Vol. 30, June 1987, pp. 5-13. 7 Refs.

The main problems in the development of CAD systems are addressed. Basic trends in AI research are reviewed, with attention given to AI problems and techniques. A three-level structure for AI research is proposed, and the prospects for using AI methods in CAD systems are considered. Three approaches to the incorporation of AI in CAD systems are examined.

A87-43648 Computer techniques in robot systems and flexible computer-aided manufacturing systems (Russian book) (Vychislitel'naia tekhnika v robototekhnicheskikh sistemakh i gibkikh avtomatizirovannykh proizvodstvakh). VIL' ZAKIROVICH RAKHMANKULOV, ZHAN PAVLOVICH AKHROMEEV, VIACHESLAV VIKTOROVICH GERASIMOV, SERGEI ALEKSANDROVICH PERESLENI, ALEKSEI MIKHAILOVICH MIKHAILOV et al. Moscow, *Izdatel'stvo Vysshaia Shkola* (Robototekhnika i Gibkie Avtomatizirovannye Proizvodstva. Vol. 4), 1986, 144 pp. 21 Refs.

The use of microprocessors in robot sensory and control systems is discussed along with programming requirements for robot systems. Also considered is the architecture of multimicrocomputer and minicomputer systems for flexible computer-aided manufacturing systems. Finally, software for flexible computer-aided manufacturing systems is examined.

A87-43647 Control of robot systems and flexible computer-aided manufacturing systems (Russian book) (Upravlenie robototekhnicheskimi sistemami i gibkimi avtomatizirovannymi proizvodstvami). IGOR' MIKHAILOVICH MAKAROV, VIL' ZAKIROVICH RAKHMANKULOV, VIKTOR MIKHAILOVICH NAZARETOV, SERGEI ALEKSEEVICH BLINOV, ALEKSEI MIKHAILOVICH MIKHAILOV et al. Moscow, *Izdatel'stvo Vysshaia Shkola* (Robototekhnika i Gibkie Avtomatizirovannye Proizvodstva. Vol. 3), 1986, 160 pp. 14 Refs.

The present work examines systems for the remote and interactive control of robots, the automatic control of robots, and the group control of robots and equipment. Methods for the analysis of the kinematic and dynamic characteristics of manipulator and locomotive robots are described. Algorithms for the control of flexible computer-aided manufacturing systems are presented.

A87-41952 A study of the relative motion of a rigid body in the atmosphere in the presence of perturbations (K issledovaniiu otnositel'nogo dvizheniia tverdogo tela v atmosfere pri deistvii vozmushchenii). G. M. LOKHOV and S. I. PODZOROV, *Akademiia Nauk SSSR, Izvestiia, Mekhanika Tverdogo Tela* (ISSN 0572-3299), Mar.-Apr. 1987, pp. 3-11. 9 Refs.

The problem of the dynamics of the relative motion of an uncontrolled rigid body in the atmosphere in the presence of perturbations is solved using an approach combining various asymptotic and numerical methods for solving equations of motion at different sections of the trajectory. The combined algorithm developed here makes it possible to reduce the computation time approximately by an order of magnitude in comparison with finite-difference numerical integration. By using asymptotic equations of the three-dimensional relative motion of a rigid body in the atmosphere in the presence of perturbations, fast computational algorithms are developed which can be used for fast analysis in computer-aided design systems.

A87-40342 K.E. Tsiolkovskii and problems in the development of science and technology (Russian book) (K.E. Tsiolkovskii i problemy razvitiia nauki i tekhniki). B. M. KEDROV and A. A. KOSMODEM'IANSKII, eds., Moscow, *Izdatel'stvo Nauka,* 1986, 192 pp.

Aspects of long-duration space flight are examined in the light of Tsiolkovskii's ideas. Particular consideration is given to advances in rocket and space technology, space-flight mechanics, and space industrialization. A number of biomedical problems connected with the prolonged stay of man in space are examined. Philosophical problems connected with space exploration are discussed along with Tsiolkovsii's theories about scientific prediction.

A87-40335 Life-support systems for space crews (Russian book) (Sistemy zhizneobespecheniia ekipazhei letatel'nykh apparatov). VLADIMIR VIKTOROVICH MALOZEMOV, VALERII FEODOS'EVICH ROZHNOV, and VLADIMIR NIKOLAEVICH PRAVETSKII, Moscow, *Izdatel'stvo Mashinostroenie,* 1986, 584 pp. 107 Refs.

The effects on humans of environmental conditions specific for a space flight, such as high altitude, cosmic radiation, weight overloads during the acceleration/deceleration stages, weightlessness, noise and vibration, magnetic fields, and ion-containing atmosphere, are discussed together with the ergonomic and technological demands placed on the life-support (LS) systems of manned spacecraft. Consideration is given to systems designed to regenerate the environment of a spacecraft, including systems for the conservation of air and water, for food storage, and for biological regeneration. Systems for maintaining the temperature and humidity inside the spacecraft and for using external heat sources are discussed. Special attention is given to mathematical models of various LS systems and subsystems. Block diagrams are included.

A87-36583 Aircraft assembly processes (Russian book) (Tekhnologiia sborki samoletov). VLADISLAV IVANOVICH ERSHOV, VIKTOR VLADIMIROVICH PAVLOV, MIKHAIL FILIPPOVICH KASHIRIN, and VADIM SERGEEVICH KHUKHOREV, Moscow, *Mizdatel'stvo Mashinostroenie,* 1986, 456 pp. 18 Refs.

The theory of aircraft assembly and the principal assembly processes are reviewed with particular attention to methods of computer-aided manufacture. Topics discussed include mathematical modeling of aircraft assembly organization; interchangeability of structural elements during assembly; typical assembly processes; and automatic control of the specialized equipment of assembly shops. Attention is also given to the evaluation of the cost effectiveness of aircraft assembly processes; design of assembly processes; and software support of CAD/CAM systems.

A87-31723 Calculation of a plane nonadjustable supersonic air intake for CAD (Raschet ploskogo nereguliruemogo vozdukhozabornika so sverkhzvukovoi skorost'iu na vykhode dlia SAPR). A. D. BOROVIKOV, D. M. DAVIDENKO, V. V. DUGANOV, and A. G. TIKHONOV, *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no. 4, 1986, pp. 20-23.

A procedure is described for the design and analysis of a plane multistep nonadjustable supersonic air intake. The procedure has been implemented in a software module written in FORTRAN-IV for a computer-aided ramjet design system. The program makes it possible to calculate isolated and ventral air intakes at zero and positive angles of attack. The procedure is illustrated by an example.

Japanese Aerospace Literature
This month: *Alloys in Structural Design*

A88-47271 Mechanism of plastic deformation of Mn-added TiAl L1(0)-type intermetallic compound. T. HANAMURA, R. UEMORI, and M. TANINO, *Journal of Materials Research* (ISSN 0884-2914), Vol. 3, July-Aug. 1988, pp. 656-664. 5 Refs.

Titanium aluminum intermetallic compound is a possible candidate for a high-temperature structural material, except for a problem of lack of room-temperature ductility. Recently, this problem was found to be overcome possibly by the addition of Mn, but this mechanism has not been fully understood yet. In order to understand the fundamental mechanism of the ductility improvement by Mn addition, microanalyses have been carried out. The results are as follows. Twin structures in a TiAl intermetallic compound in the as-cast state can be eliminated by high-temperature annealing, while those in Mn-added TiAl are thermally more stable and exist even after annealing for 86.4 ks at 1273 K. The reason for this thermal stabilization of twin structures is considered to be due to the pinning effect of twin dislocations by Mn addition. The enhancement of twin deformation in TiAl by Mn addition is regarded to be caused by two factors. One is the stabilization of twin partial dislocations, becoming the nucleation sites for twin formation. The other is the decrease in stacking fault energy, which makes twin deformation energetically easier.

A88-49096 Growth and coarsening of G.P. zones in Al-Zn alloys. KOZO OSAMURA, YOSHIYUKI AMEMIYA, HIROO HASHIZUME, and HIROSHI OKUDA, *Metallurgical Transactions A - Physical Metallurgy and Materials Science* (ISSN 0360-2133), Vol. 19A, Aug. 1988, pp. 1973-1980. 25 Refs.

The structural changes during the precipitation of G.P. zones in Al-Zn binary alloys have been investigated by means of an in situ small-angle scattering technique using synchrotron radiation. Defining a specific time, normalized by the half-completion time, the time-dependent evolution of the precipitation process can be divided into three periods independent of alloy composition and quenching conditions. The structural and kinetic features of the first two periods have been analyzed in detail. The first stage represents a growing process of clusters with diffuse interface into the well-defined G.P. zones. The average size of these clusters increases, and the density decreases. The second stage corresponds to the Ostwald ripening process. This mechanism is described by utilizing a modified Lifshitz-Slyozov-Wagner theory.

A88-49931 Structure of aluminum oxide films and their gas desorption properties. YUTAKA KATO, EIZO ISOYAMA, and MINORU HASEGAWA, *Japan Institute of Light Metals Journal* (ISSN 0451-5994), Vol. 38, Aug. 1988, pp. 462-467. 18 Refs.

The relation between the structure of aluminum oxide films on 6063 alloy and their gas desorption property was studied. 6063 alloy etched in alkali solution shows outgassing rates 4.2 x 10 to the -9th torr l/s sq cm 10 h after initial evacuation at room temperature and 1.0 x 10 to the -12th torr l/s sq cm 10 h after baking at 100 C for 24 h. The alloy etched in alkali solution, dried in vacuum and heated in Ar + O2 mixture gas shows outgassing rates 3.2 x 10 to the -10th torr l/s sq cm 10 h after initial evacuation at room temperature and 3.9 x 10 to the -12th torr l/s sq cm 10 h after baking at 100 C for 24 h. The alloy extruded in Ar + O2 shows the same outgassing rates. Porous hydrated oxide films are formed on the alloy etched in alkali solution and stored in air . The formation of hydrated oxide films during storage in air is controlled by heating in vacuum and in the Ar + O2 mixture after alkali etching. Hydrated oxide films affect outgassing rates.

A88-46624 Atomistic defect structures of Ni3Al containing C, B and Be. N. MASAHASHI, T. TAKASUGI, and O. IZUMI, *Acta Metallurgica* (ISSN 0001-6160), Vol. 36, July 1988, pp. 1815-1822. 20 Refs.

The atomistic defect structures of Ni3Al containing C, B and Be atoms were investigated using Debye-Scherrer technique and X-ray diffractometer. It was proposed that the elements of C and B occupy the interstitial site of the body centered position of the L12 structure while the elements of Be substitute for the Al site of the L12 structure. Also, it was observed that the additions of C and B atoms into the Ni3Al induced the further ordering of the constituent atoms of Ni and Al. This was more significant at the off-stoichiometric compositions of the Ni3Al. The energetic consideration, involving the nearest neighbor interactions between the constituent atoms, and between the interstitial atom and the constituent atom, was presented in order to explain the further ordering of the constituent atoms.

A88-52977 Effects of precipitate particles on structure evolution during hot rolling of 3003 aluminum alloy. TAKEYOSHI DOKO, SHIGENORI ASAMI, and KEISUKE YAGI, *Japan Institute of Light Metals Journal* (ISSN 0451-5994), Vol. 38, July 1988, pp. 386-393. 23 Refs.