AIAA JOURNAL
Vol. 30, No. 12, December 1992

Russian and Japanese Aerospace Literature

Throughout 1992 the *AIAA Journal* will carry selected abstracts on leading research topics from Russian aerospace literature and, as space permits, from similar Japanese literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features Electromagnetic Fields from Russia and Optoelectronic Devices 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-4373. Additional material can be obtained through searching the Aerospace Database—available online via DIALOG or NASA RECON.

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Russian Aerospace Literature This month: *Electromagnetic Fields*

A92-42627 Solvability of integrodifferential equations in the problem of diffraction by a perfectly conducting flat screen (Razreshimost' integrodifferentsial'nykh uravnenii v zadache difraktsii na ideal'no provodiashchem ploskom ekrane). IU. G. SMIRNOV, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 37, No. 1, Jan. 1992, pp. 32–35. 7 Refs.

Attention is given to the problem of the diffraction of a peripheral electromagnetic field by a perfectly conducting bounded flat screen located in free space with wavenumber k. The unique solvability of the integrodifferential equation to which this problem can be reduced is demonstrated for Im k greater than or equal to zero, k not equal to 0.

A92-40470 Antenna synthesis for the SPS microwave transmission system. V. A. VANKE, A. A. ZAPOROZHETS, and A. V. RACHNIKOV, *SPS 91—Power from space; Proceedings of the 2nd International Symposium,* Gif-sur-Yvette, France, Aug. 27–30, 1991 (A92-40401 16-44). Paris, Societe des Electriciens et des Electroniciens and Societe des Ingenieurs et Scientifiques de France, 1991, pp. 528–534. 15 Refs.

A promising application of the SPS microwave power transmission system with radially polarized field at the antennas is discussed. It is shown that in this case more power can be transmitted at a reduced electricity cost.

A92-36560 Possibility of a causal analysis of geophysical processes (O vozmozhnosti prichinnogo analiza geofizicheskikh protsessov). S. M. KOROTAEV, *Geomagnetizm i Aeronomiia* (ISSN 0016-7940), Vol. 32, No. 1, Jan.–Feb. 1992, pp. 27–33. 7 Refs.

The possibility of a formal definition of cause-effect relationships is shown. The proposed approach of causal analysis is applied to the case of an electromagnetic field excited by a sea current. The formally obtained result is shown to correspond to the intuitively expected one, which suggests that this type of causal analysis can be successfully used in practical studies of various geophysical processes.

A92-21606 Electromagnetic-field radiation from a finite array of grooved waveguides (Izluchenie elektromagnitnogo polia konechnoi reshetkoi zhelobkovykh volnovodov). IU. P. VINNICHENKO and A. E. TUMANSKAIA, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 36, Dec. 1991, pp. 2313–2321. 3 Refs.

The method of partial domains employing Kirchhoff's formula is used to solve the problem of EM-field radiation from a finite nonequidistant array of asymmetric grooved waveguides. The characteristics of a structure composed of three grooved radiators with a metallic screen are presented, and the results are illustrated by numerical calculations.

A92-39496 Study of electromagnetic emissive power of moving ionospheric plasma on the basis of universal numerical model constructed on exact expressions. V. L. SAVEL'EV and E. V. ZHELEZNIAKOV, *Planetary and Space Science* (ISSN 0032-0633), Vol. 40, No. 4, April 1992, pp. 509–517. 14 Refs.

The exact Green's function for the problem of generation of electromagnetic disturbances by vertically inhomogeneous acoustic-gravity waves has been constructed for a homogeneous non-isotropic plasma. Explicit analytical expressions for the calculation of the electromagnetic field have been obtained for an inhomogeneous plane-stratified ionosphere. The results of the numerical evaluation of the Green's function, characterizing the emissive power of real moving ionospheric plasma are given. The influence of the AGW wave vector direction on the effectiveness of the two types of wave disturbance excitation in an ionospheric plasma has been studied.

A92-36619 Self-localized electromagnetic vortex in a dense gas (Samolokalizovannyi elektromagnitnyi vikhr' v plotnom gaze). IU. R. ALANAKIAN, *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0044-4510), Vol. 101, No. 1, 1992, pp. 99–110. 18 Refs.

A self-localized electromagnetic vortex whose localization region is surrounded by a plasma with a high electron temperature is examined in the case where plasma in the internal vortex region is compressed by the vortex to such an extent that its pressure significantly exceeds the plasma pressure in the external region. It is shown that, in this case, the vortex energy and plasma pressure in the internal region are directly proportional to each other. The analysis takes into account plasma electron entrainment by the vortex, which leads to magnetic field generation. It is further shown that the presence of a permanent magnetic field contributes to a reduction of energy losses resulting from the migration of hot particles from plasma to the ambient gas. The vortex and plasma parameters are estimated for the case where the vortex is formed in a gas whose composition and pressure are nearly atmospheric.

A92-10917 Edge field singularity in a chiral medium (Osobennost' polia na rebre v kiral'noi srede). V. V. FISANOV, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 36, Aug. 1991, pp. 1488–1491. 9 Refs.

The Meixner method is used to investigate an electromagnetic-field singularity at the edge of a wedge-shaped region in the presence of an isotropic chiral medium. Exact solutions of the characteristic equations with respect to the singularity index are obtained for a combination of one- and two-sector structures with conducting boundaries, as well as for a chiral wedge in a nonchiral medium.

A92-36561 Automatic measurement of the arrival direction of whistlers (Avtomaticheskoe izmerenie napravleniia prikhoda svisti-ashchikh atmosferikov). K. OHTA and M. HAYAKAWA, *Geomagnetizm i Aeronomiia* (ISSN 0016-7940), Vol. 32, No. 1, Jan.–Feb. 1992, pp. 34–41. 24 Refs.

A fully automated system for recording the arrival direction of whistlers is described which uses observations of horizontal magnetic and vertical electric components of the wave field. A signal from three antennas at two selected frequencies is digitized by an ADC and stored in its temporary memory until a signal identified as the whistler arrives at the antenna input. The information is then transferred to a microcomputer. The wave arrival direction and polarization are determined through measurement of the ratio of the amplitudes and phase difference of the magnetic components to the vertical electric component. An example of data analysis using this technique is presented.

A92-33752 Use of discrete components of FSK frequency signals for investigating the effects of cosmic and geophysical factors on the earth's biosphere (O primenimosti diskretnykh sostavnykh chastot-nykh signalov s chastotnoi manipuliatsiei dlia issledovaniia vliianiia kosmicheskikh i geofizicheskikh faktorov na biosferu zemli). S. N. DAROVSKIKH, *Akademiia Nauk SSSR, Izvestiia, Seriia Biologicheskaia* (ISSN 0002-3329), Jan.–Feb. 1992, pp. 138–142. 8 Refs.

Earlier studies showed a close correlation between various biological processes and the variations in the earth's magnetic field caused by cosmic and geophysical explosive events. In this paper, the frequency-time structure of electromagnetic variations of the earth's field was estimated by analyzing the possible mechanism of the compression of sound information in neuron networks. Examples are presented demonstrating the accuracy of the estimated structure of electromagnetic variations.

A92-30394 Electromagnetic field of a dipole isolated by a dielectric sphere (Elektromagnitnoe pole izolirovannogo dielektricheskim sharom dipolia). V. N. MITROKHIN, *Moskovskii Gosudarstvennyi Tekhnicheskii Universitet, Vestnik, Seriia Priborostroenie* (ISSN 0236-3933), July–Sept. 1991, pp. 31–40. Refs.

The concept of the critical cross sections of inhomogeneous waveguides is used to establish the upper bound for the near field of an elementary dielectric dipole, making it possible to analyze the electromagnetic field of a dipole isolated by a dielectric sphere. It is shown that the radiation resistance of the isolated dipole increases significantly when the radius of the dielectric sphere exceeds the internal critical cross section of the fundamental lower mode, E01, of a layered spherical wave guide.

A92-30393 Natural modes of plasma-dielectric waveguides (Sob-stvennye volny plazmenno-dielektricheskikh volnovodov). N. A. BEI and S. P. DRUKARENKO, *Moskovskii Gosudarstvennyi Tekhnicheskii Universitet, Vestnik, Seriia Priborostroenie* (ISSN 0236-3933), July–Sept. 1991, pp. 21–30. Refs.

Results of a numerical analysis of the natural modes of multilayer plasma-dielectric waveguides are presented. The characteristics of fast and slow waves in open and shielded waveguides are considered.

A92-30359 Change in the adiabatic invariant on critical sections of inhomogeneous waveguides (Izmenenie adiabaticheskogo invarianta na kriticheskikh secheniiakh neodnorodnykh volnovodov). V. N. MITROKHIN, *Moskovskii Gosudarstvennyi Tekhnicheskii Universitet, Vestnik, Seriia Priborostroenie* (ISSN 0236-3933), Oct.–Dec. 1990, pp. 53–60.

Radiation of the natural-mode field from the critical section of an inhomogeneous waveguide is investigated which occurs due to a stepwise change in the adiabatic invariant. Attention is given to inhomogeneous waveguides with spherical and cylindrical guided waves.

A92-28386 Calculation of the parameters of a dipole antenna with capacitance inserts (Raschet parametrov vibratornoi antenny s emkostnymi vstavkami). V. G. SAIKO, *Radioelektronika* (ISSN 0021-3470), Vol. 34, Nov. 1991, pp. 17–22. 3 Refs.

An approach is proposed for analyzing physical processes taking place in an antenna with capacitance inserts which improve the range characteristics of dipole antennas. A solution is presented for the problem of electromagnetic energy propagation in a homogeneous two-way transmission line with reactive inserts. Expressions are obtained for calculating the internal and external characteristics of dipole antennas with capacitance inserts.

A92-14311 A study of electromagnetic radiation generated by snowfalls and snowstorms (Issledovanie elektromagnitnogo izlucheniia, generiruemogo snegopadami i meteliami). V. IA. ANDROSENKO, E. S. BAIAR, V. F. PSALOMSHCHIKOV, and IU. B. KARDANOV, *Physics of clouds and modification of hail processes* (A92-14301 03-47). Moscow, Gidrometeoizdat, 1990, pp. 62-64. 5 Refs.

Data are presented demonstrating the appearance of electromagnetic fields (EMFs) during snowfalls and snowstorms. It is shown that the EMFs generated by snowfalls differ significantly from those generated by snowstorms in terms of intensity and spectral characteristics. Namely, EMFs generated by snowstorms have a frequency range of 3 kHz and are registered in the form of pulse packets, whereas the snowfall-generated EMFs display a continuous frequency spectrum, from a fraction of a kHz to 30 Mhz. The mechanisms involved in EMF generation during snowfalls and snowstorms are discussed.

A92-28373 Wave diffraction on semiinfinite periodic structures (Difraktsiia khvil' na napivskinchennikh periodichnikh strukturakh). L. M. LITVINENKO, I. I. REZNIK, and D. L. LITVINENKO, *Akademiia Nauk Ukrains'koi RSR, Dopovidi, Matematika, Prirodoznavstvo, Tekhnichni Nauki* (ISSN 0868-8052), June 1991, pp. 62–66. 2 Refs.

The paper deals with a wide range of problems of wave diffraction on a semiinfinite series of evenly spaced identical obstacles, such as semitransparent screens, dielectric layers, and waveguide diaphragms. A numerical-analytical solution method is proposed which is based on the partial reversal of the problem operator. The method is illustrated by examples.

A92-27478 Nonlinear theory for an amplifying peniomagnetron (Neliniina teoriia pidsiliuiuchogo peniomagnetrona). V. D. ER'OMKA, V. O. ZHURAKHOVS'KII, and A. M. KOVALENKO, *Akademiia Nauk Ukrains'koi RSR, Dopovidi, Matematika, Prirodoznavstvo, Tekhnichni Nauki* (ISSN 0868-8052), Jan. 1991, pp. 51–54. In Ukrainian. 4 Refs.

A nonlinear theory is presented for an amplifying peniomagnetron in which a monohelical electron flux traveling in a profiled magnetostatic field interacts in the peniotron regime with the electromagnetic field of the slow wave of an azimuthally periodic waveguide. A numerical analysis of the equations obtained here indicates that the electron efficiency of the device near the theoretical limit is independent of the gyroresonance order and equals 100 percent. The existence of an operating regime that does not require magnetostatic field profiling is demonstrated.

A92-25947 Determination of the directive gain of antennas on the basis of field measurements in the near zone (Opredelenie koeffit-sienta napravlennogo deistviia antenn po izmereniiam polia v blizhnei zone). V. A. USIN and O. D. ANOKHINA, *Radiotekhnika* (ISSN 0485-8972), No. 95, 1990, pp. 79–85. 7 Refs.

A method for determining antenna directive gain on the basis of near-field measurements on a cylindrical surface is described, and its practical implementation is discussed. The directive gain can be determined in two steps. Frist, rapid processing is carried out and information about the position of the directive-gain peak is obtained, and this information is then used to evaluate the directive gain in the total measurement cycle.

A92-21921 Surface impedance characteristics and negative dielectric permittivity of high-temperature superconductor compounds in the frequency range 2-6 GHz (Osobennosti poverkhnostnogo impedansa i otritsatel'naia dielektricheskaia pronitsaemost' v VTSP soedineniiakh v oblasti chastot 2-6 GGts). A. S. SHCHERBAKOV, D. N. KOUROV, V. E. STARTSEV, E. G. VALIULIN, G. M. SAMOILENKO, S. N. ARTEMENKO, and V. L. KAMINSKII, *Fizika Nizkikh Temperatur* (ISSN 0132-6414), Vol. 17, Oct. 1991, pp. 1427–1430. Refs.

Results of measurements of the frequency dependences of the real and imaginary components of surface impedance in the ranges 10-130 MHz and 1.95-6 GHz are reported for EuBa2Cu3O(6.9) high-temperature superconductor. The results reveal an anomalous behavior of surface impedance, providing support for the conclusion about the resonance absorption of an electromagnetic field in high-temperature superconductors. The surface impedance behavior is discussed in relation to the anomalous dispersion of the dielectric permittivity of the superconductor.

A92-17745 A theory of PLHR emissions to explain the weekly variation of ELF data observed by a low-altitude satellite. O. A. MOLCHANOV, M. PARROT, F. LEFEUVRE, and M. M. MOGILEVSKII, *Annales Geophysicae* (ISSN 0939-4176), Vol. 9, Oct. 1991, pp. 669–680. 39 Refs.

Power-Line Harmonic Radiation (PLHR) penetrates through the atmosphere up to the ionosphere and the magnetosphere, where it influences energy flux in a variable manner. The cause of this variation may lie in the fact that the electrical power produced is weaker on Saturdays and Sundays, and it is also supposed that the current distribution at the surface of the earth during the weekend must be different from that on weekdays. For this reason, two different models are used: a ring distribution from Monday to Friday and an octopus-shaped distribution for Saturday and Sunday. It is shown that the energy flux at the ionospheric boundary is larger for the ring distribution, and that the parallel current calculated in the ionosphere shows a maximum on Monday-Tuesday and then decreases until the end of the week. The variation of this theoretical current is similar to the variation in the intensity of ELF emissions observed at different frequencies by a low-orbiting satellite.

A91-49374 Method for investigating the radiation parameters of self-phasing antennas for coherent communications with a moving object (Metod issledovaniia parametrov izlucheniia samo-faziruiushchikhsia antenn kogerentnoi sviazi s dvizhushchimsia ob'ektom). V. G. ERIKHOV and D. E. MASLOV, *Radiotekhnika* (ISSN 0033-8486), May 1991, pp. 81–83.

A method is developed for calculating the radiation parameters of self-phasing antennas which provide for coherent communications with a moving object. The method considers the instantaneous phase of the radiated and received electromagnetic field in the coordinate systems of the radiation source and the receiving antenna, based on the invariance of the instantaneous phase relative to the Lorentz transformation with transition from one coordinate system to the other. Examples of the practical application of this method are discussed.

A92-21912 Detection of superconductivity at 127 K in Y-Sc-Ba-Cu-O specimens in an alternating electromagnetic field (Obnaruzhenie sverkhprovodimosti pri 127 K v obraztsakh Y-Sc-Ba-Cu-O v peremennom elektromagnitnom pole). A. M. GUREVICH, V. V. DEMIRSKII, V. M. DMITRIEV, V. I. DOTSENKO, V. N. EROPKIN, A. P. ISAKINA, M. N. OFITSEROV, N. N. PRENTSLAU, A. I. PROKHVATILOV, L. V. SHLYK, et al., *Fizika Nizkikh Temperatur* (ISSN 0132-6414), Vol. 17, Oct. 1991, pp. 1358–1362. Refs.

Reference is made to an earlier study (Bush et al., 1989) in which it was shown that the addition of Sc and Sr atoms to a yttrium ceramic, (Y(1-x)Sc(x))(Ba(1-y)Sr(y))Cu3O(7-delta), increases the critical superconductivity temperature of the ceramic to 110 K. In the present study, experimental data are presented on the energy absorption of the ceramic at 10 exp 5—1.3 x 10 exp 7 Hz, its specific heat, and lattice parameters in the temperature range 78-150 K for x = 0.15, y = 0. At 10 exp 5 Hz, superconductivity is observed at 91.5 K during the cooling of the ceramic. During subsequent heating, the superconducting state is retained up to a temperature of 127 K.

A92-18397 On the Schumann resonances on Mars. A. I. SUKHORUKOV, *Planetary and Space Science* (ISSN 0032-0633), Vol. 39, Dec. 1991, pp. 1673–1676. 17 Refs.

A conductive ionosphere and a totally nonconductive layer of the atmosphere close to the surface of the planet form a quasi-spherical concentric resonator. This provides the possibility of global resonances of an electromagnetic field generated by thunderstorm activity or by hydromagnetic waves excited in an upper ionosphere and transformed into ordinary electromagnetic waves while penetrating the resonator. An estimate of resonance frequencies is given for a Martian resonator: f1 is about 13-14 Hz, f2 is about 24-26 Hz, f3 is about 35-38 Hz, etc. for two essentially different models of electron-density distribution in the low ionosphere of Mars. The corresponding estimated quality values are low: Q sub n is about 2-4. A relatively wide range of the quality variation depending on a model of averaged altitudinal electron-density distribution in the low ionosphere of Mars yields the criterion for an adequate model.

A92-14319 Spectral characteristics of electromagnetic radiation induced by deformation processes in snow and ice (Spektral'nye kharakteristiki elektromagnitnogo izlucheniia, voznikaiushchego pri deformatsionnykh protsessakh v snezhno-ledianykh sredakh). V. IA. ANDROSENKO, E. S. BAIAR, V. F. PSALOMSHCHIKOV, and IU. B. KARDANOV, *Physics of clouds and modification of hail processes* (A92-14301 03-47). Moscow, Gidrometeoizdat, 1990, pp. 106–109. Refs.

Mechanisms involved in the generation of electromagnetic radiation (EMR) fields in the process of deformation of snow and ice are investigated with special attention given to the relationship between the acoustic emission (AE) and EMR occurring simultaneously during snow and ice cracking. Results of an analysis of the electric and the magnetic components of EMR occurring during ice cracking with weak AE show that the main mechanism for EMF generation under these conditions is the occurrence of electric discharges due to the destruction of a dielectric medium. On the other hand, in cases of intense AE, EMR may occur simultaneously with AE. These EMR fields are characterized by a low-frequency spectral range, as was observed in laboratory experiments during intensive shifting of snow masses.

A92-10018 Spectral structure of ultralow-frequency electromagnetic fields near Comet Halley. IU. M. MIKHAILOV, O. V. KAPUSTINA, G. A. MIKHAILOVA, E. G. EROSHENKO, V. A. STIAZHKIN, J. G. TROTIGNON, and K. SAUER, *Cometary plasma processes* (A92-10001 01-90). Washington, DC, American Geophysical Union, 1991, pp. 171–177. 17 Refs.

The energy spectra of electromagnetic field and plasma density in the 0.0001-0.04 Hz frequency band observed on Vega 1 behind bow shock are presented. It has been shown that the spectral maxima coincide with the cyclotron frequencies of cometary molecular ions.

A91-50904 Boundary conditions for a two-layer two-dimensionally periodic structure (Granichnye usloviia dlia dvukhsloinoi dvumerno-periodicheskoi struktury). O. N. TERESHIN and V. D. DVURECHENSKII, *Radiotekhnika* (ISSN 0033-8486), June 1991, pp. 62–64. Refs.

Attention is given to a two-dimensionally periodic impedance structure of finite thickness consisting of two identical plane infinitely thin periodically loaded ribbon structures situated one beneath the other at a distance h much less than lambda. Expressions are obtained which relate the tangential components of the mean electromagnetic field Eyn, Hxn to the periodic impedance reactive loads. These expressions can be considered as impedance boundary conditions that must be satisfied by electromagnetic fields on the surface of a two-dimensionally periodic impedance structure of 'ladder' type.

A91-45024 Pulsed radiation of an antenna (An electromagnetic missile) (Impul'snoe izluchenie antenny /Elektromagnitnyi snariad/). L. G. SODIN, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 36, May 1991, pp. 1014–1022. 5 Refs.

An analysis is made of the radiation of an antenna excited by a short peripheral-current pulse. Attention is given to the spatial and temporal characteristics of the pulsed electromagnetic field associated with the 'electromagnetic missile' effect. Conditions are determined under which a high energy concentration is observed in narrow time and space intervals.

A91-50829 Wave diffraction by an imperfectly conducting echelette (Difraktsiia voln na neideal'no provodiashchem eshelette). S. A. MASALOV, A. V. RYZHAK, and V. M. SHKIL', *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 36, June 1991, pp. 1107–1113. 9 Refs.

The problem of wave diffraction by an echelette with imperfect conductivity of the edges is solved on the basis of the semiinversion method using Leontovich impedance boundary conditions. The effect of the impedance on the diffraction properties of the echelette is evaluated.

A91-47570 Electromagnetic waves in a rotating universe (Elektromagnitnye volny vo vrashchaiushcheisia vselennoi). KOROTKII, V. A. OBUKHOV, IU. N. Moskovskii Universitet, Vestnik, Seriia 3—Fizika, Astronomiia (ISSN 0579-9392), Vol. 32, Mar.–Apr. 1991, pp. 3–6. 6 Refs.

An exact solution is obtained for electromagnetic waves in a cosmological model with Goedel-type rotation. It is shown that the character of the propagation and the wave spectrum are determined solely by rotation and do not depend on the causal structure of the space-time.

A91-42314 Nonlinear interaction of an electron beam with the field of a slow-wave structure inside and outside its transmission band (Nelineinoe vzaimodeistvie elektronnogo potoka s polem zamedliaiushchei sistemy vnutri i vne ee polosy prozrachnosti). I. A. MAN'KIN and B. L. USHEROVICH, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 36, April 1991, pp. 767–777. 14 Refs.

Consideration is given to aspects of the nonlinear interaction of an electron beam with the electromagnetic field of a periodic structure both inside and outside its transmission band. A description is given of a fairly general method for the numerical analysis of the nonlinear characteristics of a multisection TWT with a slow-wave structure of coupled-resonator-chain type.

A91-39149 Synthesis of antenna arrays of open ends of waveguides (Sintez antennykh reshetok iz otkrytykh kontsov volnovodov). V. V. RIAPOLOV and V. M. FIDORENKO, *Radiotekhnika* (ISSN 0033-8486), March 1991, pp. 68–70.

A method is proposed for solving inverse problems concerning antenna arrays of open ends of waveguides. Results are presented here for arrays of open ends of rectangular waveguides; it is noted, however, that the method is also suitable for nonrectangular waveguides.

A91-37618 A method of analyzing focused electromagnetic fields (Metod analiza sfokusirovannogo elektromagnitnogo polia). E. L. MOLOTKOV and V. P. SHVETSOV, *Radiofizika* (ISSN 0021-3462), Vol. 33, Oct. 1990, pp. 1144–1149.

A vector-analysis method designed for E-polarized focused electromagnetic radiation is presented. An operator method for determining all electric and magnetic field components from the known scalar solution is proposed. Analytical formulas are derived and the properties of vector solutions are investigated. The proposed method is suitable for analyzing the near fields of antennas.

A91-37617 Generalization of Sommerfeld's solution for a scattered field to describe diffraction by an impedance half-plane (Obobshchenie zommerfel'dovskoi formy rasseiannogo polia na sluchai opisaniia iavlenii difraktsii na impedansnoi poluploskosti). A. V. KUKUSHKIN, *Radiofizika* (ISSN 0021-3462), Vol. 33, Oct. 1990, pp. 1138–1143. 9 Refs.

An analytical continuation of Sommerfield's solution to describe diffraction by an impedance half-plane is proposed. Here bilateral boundary conditions are satisfied asymptotically. Solutions are validated for the reactance half-plane excited by a surface wave. Validation findings show a high effectiveness of solutions which are also convenient in analyzing the qualitative characteristics of physical phenomena in open semiinfinite guided-wave structures.

A91-37265 Indication of a microwave field by an optical-waveguide-type electrooptical sensor (Indikatsiia elektromagnitnogo polia SVCh-volny svetovodnym elektrooptycheskim datchikom). V. K. GORCHAKOV, V. V. KUTSAENKO, V. T. POTAPOV, and S. G. CHIGAREV, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 36, March 1991, pp. 590–594. 5 Refs.

A novel electrooptical sensor for measuring the characteristics of a microwave field has been developed whose principle of operation is based on the Pockels electrooptical effect. Results of an experimental investigation of the sensor in a microwave waveguide at a frequency of 36.6 GHz and a microwave power level up to 8 kW are presented. It is shown that this sensor makes possible absolute measurement of the microwave-field power and visualization of the microwave-pulse envelope.

A91-23943 Equations for reconstruction of the phase of an electromagnetic field (Uravneniia dlia vosstanovleniia fazy elektromagnitnogo polia). V. V. KOTLIAR and V. A. SOIFER, *Radiofizika* (ISSN 0021-3462), Vol. 33, July 1990, pp. 813–817. Refs.

The phase distribution of an electromagnetic field contains information on the geometric and physical characteristics of the surface by which it is scattered or refracted. It is thus important to find a definite relation between the intensity distribution of the field, which can be measured experimentally, and its phase distribution. This paper gives some new results on the possibility of using the fundamental equations of the scalar theory of diffraction to reconstruct the phase of an electromagnetic field by measuring its intensity on two or more close planes.

A91-33855 Field transducer without background (Besfonovyi preobrazovatel' polia). M. L. PEREIASLAVETS, A. N. SIVOV, and A. D. CHUPRIN, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 36, Jan. 1991, pp. 42–47. 10 Refs.

The paper develops a method for designing a two-dimensional electromagnetic-field transducer which is formed by three curvilinear or four plane semitransparent surfaces having a transparence that is variable along the surface. It is shown that the spatial structure of different microwave fields in the waveguide or in free space (antenna devices) can be transformed precisely (without background). Numerical results are presented.

A91-32418 Propagation of electromagnetic fields from seismic sources into the upper ionosphere (Prokhozhdenie elektromagnitnykh polei ot seismicheskikh istochnikov v verkhniuiu ionosferu zemli). O. A. MOLCHANOV, *Geomagnetizm i Aeronomiia* (ISSN 0016-7940), Vol. 31, Jan.–Feb. 1991, pp. 111–119. 13 Refs.

A theoretical analysis indicates that the propagation of wideband electromagnetic radiation from a seismic source through the earth's surface, the lower atmosphere, and the ionosphere leads to the excitation of oblique Alfven waves in the 0.3-10 Hz range in the upper ionosphere and magnetosphere. The propagation efficiency is greater for a magnetic-type source than for an electric-type source, and increases with decreasing conductivity of the earth. The excitation zone is circular with a radius of 100-150 km.

A91-37245 Reflection properties of an optically controlled panel based on a semiconductor-dielectric-metal structure (Otrazhatel'nye svoistva optoupravliaemoi paneli na osnove struktury poluprovodnik-dielektrik-metall). A. E. ZAIKIN, P. I. PETROV, and A. V. POLIAKOV, *Radioelektronika* (ISSN 0021-3470), Vol. 34, Feb. 1991, pp. 81-84.

The design of an optically controlled semiconductor-dielectric-metal panel for use in microwave visualization devices is described. Experimental results are shown to agree well with the theoretical design considerations.

A91-37247 Oscillation spectrum of a cylindrical resonator tuned by a dielectric rod (Spektr kolebanii tsilindricheskogo rezonatora, perestraivaemogo dielektricheskim sterzhnem). IU. G. BELOV, A. S. KOGTEV, L. G. RUDOIASOVA, and G. I. SHISHKOV, *Radioelektronika* (ISSN 0021-3470), Vol. 34, Feb. 1991, pp. 90–92.

The method of partial regions is used to analyze the resonant mode spectrum of a cylindrical resonator tuned by a dielectric rod. The resonant value of the wavenumber of the working mode E010 is calculated as a function of the relative length of the dielectric rod.

A91-33863 Nonstationary processes in a gyrotron with an unfixed RF-field structure (Nestatsionarnye protsessy v girotrone s nefiksirovannoi strukturoi VCh-polia). N. A. ZAVOL'SKII and G. S. NUSINOVICH, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 36, Jan. 1991, pp. 135–141. 7 Refs.

A theory is developed which makes it possible to describe nonstationary processes in a gyrotron with an oversize low-Q resonator whose Rf field can be unfixed with respect to both the longitudinal and the azimuthal coordinate. The results obtained make it possible to determine the limiting dimensions of resonators in the case of which high-efficiency stable single-mode oscillation is possible.

A91-37229 Structure of the energy spectrum of the radiation field of active phased-array antenna for the case of the monochromatic signal of the exciter (Struktura energeticheskogo spektra polia izlucheniia aktivnykh FAR pri monokhromaticheskom signale vozbuditelia). V. L. GOSTIUKHIN and V. N. TRUSOV, *Radioelektronika* (ISSN 0021-3470), Vol. 34, Feb. 1991, pp. 21–26.

The characteristics of secondary radiation of active phased arrays in the presence of noise at the input of the active modules are analyzed. A spectral-correlation investigation of the problem makes it possible to obtain analytical expressions for the components of the complete energy spectrum and to establish their dependence on the spatial coordinates.

Japanese Aerospace Literature
This month: *Optoelectronic Devices*

A92-38955 Optoelectronic adaptive neuro-device. H. YONEZU, K. KANAMORI, K. TSUJI, T. HIMENO, Y. TAKANO, and K. PAK, *Electronics Letters* (ISSN 0013-5194), Vol. 28, No. 8, April 9, 1992, pp. 715–717. Research supported by MOESC and Research Foundation for the Electrotechnology of Chubu. 5 Refs.

The development of a new adaptive neurodevice with a nonvolatile memory function is reported. The adaptive neurodevice is based on EEPROM technology and has additional control electrodes; the synaptic weights are varied during operation depending on target signals. The device can be used for implementing learning algorithms for self-organizing neural networks. It can also be used in hardware implementing learning algorithms without a teacher or in other adaptive circuits where the desired output varies according to reference signals.

A92-32428 A new optical neuron device for all-optical neural networks. KOJI AKIYAMA, AKIO TAKIMOTO, MICHIHIRO MIYAUCHI, YASUNORI KURATOMI, JUNKO ASAYAMA, and HISAHITO OGAWA, *Japanese Journal of Applied Physics, Part 1* (ISSN 0021-4922), Vol. 30, Dec. 1991, pp. 3887–3892. 9 Refs.

A new optical neuron device has been developed. The device can perform both summation and thresholding operations in optics, and consists of a PIN a Si:H photoreceptor, aluminum neuron electrodes and a ferroelectric liquid crystal light modulator. The a-Si:H photoreceptor shows characteristics of an ideal quantum efficiency and a good linearity. The optical neuron device exhibits a response time of about 30 microns for incident light power of 9 microW and a contrast ratio of 300:1. Using this neuron device, a lenslet array and a memory mask, an all-optical neural network has been constructed. The network demonstrates an associate memory function on purely optical parallel processing without any help from electric computation.

A92-31744 Operational wavelength range of GaInAs(P)-InP intersectional optical switches using field-induced electrooptic effect in low-dimensional quantum-well structures. KAZUHIKO SHIMOMURA, SHIGEHISA ARAI, and YASUHARU SUEMATSU, *IEEE Journal of Quantum Electronics* (ISSN 0018-9197), Vol. 28, Feb. 1992, pp. 471–478. Research supported by MOESC and Tepco Research Foundation. 32 Refs.

Operational wavelength range for low insertion loss and high extinction ratio of GaInAs(P)-InP intersectional optical switches consisting of low-dimensional quantum-well structures, such as quantum-box, quantum-wire, and quantum-film structures, is theoretically analyzed. It is found that superior operation characteristics can be attained with the lower-dimensional quantum-well structure. For instance, an operational wavelength range of around 10 nm for an insertion loss less than 1 dB and an extinction ratio higher than 50 dB can be obtained with the device using a quantum-box structure.

A92-38834 Dynamic set and reset operations with a single optical beam for an InGaAsP/InP optoelectronic latching device. KENICHI MATSUDA and JUN SHIBATA, *IEEE Photonics Technology Letters* (ISSN 1041-1135), Vol. 4, No. 5, May 1992, pp. 483–485. 11 Refs.

A novel optoelectronic latching device is proposed and demonstrated. The device has a stacked structure consisting of a light-emitting diode (LED) and two heterojunction phototransistors (HPTs). The LED and one of the HPTs are connected electrically in series to form a bistable switch based on optical positive feedback. The other HPT is connected in parallel to the switch for reset operation. A single optical beam modulated with pulse signals is input to both HPTs simultaneously. The optical pulse with a peak power ranging from 7 to 30 micro-W turns on the switch, and the pulse with higher optical power turns it off.

A92-34846 Novel optoelectronic RS flipflop based on optically coupled inverters. T. CHINO, K. MATSUDA, H. ADACHI, and J. SHIBATA, *Electronics Letters* (ISSN 0013-5194), Vol. 28, No. 7, March 26, 1992, pp. 641, 642. 5 Refs.

An optoelectronic RS flipflop emitting differential output has been proposed and demonstrated. It consists of two optical inverters. Optical interconnections are used to couple these inverters. Stable operation for the variation of bias voltage is demonstrated, which exhibits the possibility for 2-dimensional integration.

A91-41060 Organic patch sensor for electro-optic measurement of electrical signals in integrated circuits. T. NAGATSUMA, M. YAITA, M. SHINAGAWA, M. AMANO, and Y. SHUTO, *Electronics Letters* (ISSN 0013-5194), Vol. 27, May 23, 1991, pp. 932–934. 6 Refs.

A highly sensitive, versatile and low-cost electric field sensor has been developed for measuring internal electrical signals in integrated circuits using an electrooptic sampling technique. This sensor uses an organic nonlinear optical (NLO) polymer coated on thin polyimide films and is directly bonded to the circuit under test without a mirror coating. Electrooptic sampling was conducted using the sensor, and a voltage sensitivity of less than a few tens of millivolts was obtained.

A90-51592 Proposed for device transplantation using a focused ion beam. TSUYOSHI OHNISHI, YOSHIMI KAWANAMI, TOHRU ISHTANI, *Japanese Journal of Applied Physics, Part 2* (ISSN 0021-4922), Vol. 29, Jan. 1990, pp. L188–L190. 19 Refs.

Device transplantation using a focused ion beam (FIB) has been proposed as a new high-resolution technique for microdevice assembly as well as device repair. FIB sputtering, redeposition, and FIB-induced deposition each work as a cutter or a fixer. Feasibility experiments have been carried out both for dummy-device transplantation on a silicon substrate and for microgear fabrication.