

# Soviet and Japanese Aerospace Literature

Throughout 1991 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 Fiber Optics from the USSR and Satellite Communications from Japan.

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## Soviet Aerospace Literature This month: *Fiber Optics*

**A91-25242** Fiber-optic flow diagnostic systems (VoloKonno-opticheskaya tekhnika diagnostiki potokov). S. N. KHOTIAINTSEV, *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seria Tekhnicheskikh Nauk* (ISSN 0002-3434), Aug. 1990, pp. 38-42. 65 Refs.

Results of investigations of photoinduced second harmonic generation in quartz-glass optical fibers are reviewed. Attention is given to a microscopic coherent photogalvanic effect mechanism which leads to the generation of an intense transverse electrostatic field in the core of the waveguide. Impurity complexes whose characteristics correspond to this mechanism are found on the basis of the numerical simulation of quartz-glass defects, based on a semiempirical quantum-chemical method in the cluster approximation.

**A91-24000** Fiber-optic transmission lines for antenna systems (VoloKonno-opticheskie linii peredachi dlia antenykh ustroystv). A. V. SIDORENKO and V. S. KURILO, *Radioelektronika* (ISSN 0021-3470), Vol. 33, Nov. 1990, pp. 77-79. 14 Refs.

A process is described for producing anisotropic single-mode waveguide with an elliptic tension cladding and a round core. Waveguides have been produced with a birefringence of 0.0001-0.0003, a polarization mode coupling coefficient of  $(5-7) \times 10$  to the  $-5$ th/m, and optical losses of 0.5 dB/km in the 1.6-micron region. The experimental results are compared with the results of theoretical analysis. Mechanisms are identified which limit the capability of the waveguides investigated to maintain the polarization of linearly polarized emission coupled into the waveguide.

**A90-44996** Fiber-optic interferometers—The control of the radiation-spectrum structure and the formation of high-intensity optical pulses (VoloKonnoopticheskie interferometriy—Kontrol' spektral'nogo sostava izlucheniia i formirovaniye intensivnykh opticheskikh impul'sov). A. G. BULUSHEV, E. M. DIANOV, A. V. KUZNETSOV, O. G. OKHOTNIKOV, V. M. PARAMONOV et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, May 1990, pp. 621-626. 20 Refs.

The feasibility of using a single-mode fiber-optic ring interferometer for narrowing a semiconductor-laser line and increasing the output radiation was investigated. It is shown that radiation from a multifrequency injection laser with an external resonator, operating both under CW and under mode-locking conditions, can be effectively inserted into a fiber-optic ring interferometer. By matching the optical lengths of the external resonator and the interferometer, the mode width of this laser could be measured. A method is proposed for generating optical pulses in a fiber-optic ring interferometer by frequency-modulated radiation which is continuous with respect to intensity.

**A91-13703** Correlated tuning of the speckle pattern in an interferometer based on a multimode fiber-optic waveguide (Korrelirovaniye perestroika kartiny spekvov v interferometre na mnogomodovom volokonnom svetovode). I. U. A. BYKOVSKI, I. U. N. KUL'CHIN, V. F. OBUKH, and V. L. SMIRNOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, Aug. 1990, pp. 1080-1083. 13 Refs.

The correlated tuning of the speckle pattern in the radiation field of a single-fiber multimode interferometer is investigated experimentally and analytically in the presence of external action. It is found that correlated changes in the speckle pattern are observed in both the near and the far emission fields of the waveguide. An expression is obtained which provides a way to determine the maximum size of the speckle correlation region. The use of spatial filtering for isolating the effect of correlated speckle pattern tuning is suggested. It is shown that the use of a spatial filter makes it possible to increase the efficiency of fiber-optic transducers.

**A91-13671** Coupling of a semiconductor visible laser to a single-mode fiber-optic waveguide (Stykovka poluprovodnikovogo lazera vidimogo diapazona s odnomodovym volokonnyim svetovodom). V. A. DOMBROVSKII, S. A. DOMBROVSKII, E. F. PEN, A. N. POTAPOV, and Z. L. PUSTOVAIA, *Avtometriia* (ISSN 0320-7102), May-June 1990, pp. 9-14. 20 Refs.

The coupling of the emission of a semiconductor laser operating at a wavelength of 665 nm into a single mode fiber-optic waveguide is investigated theoretically and experimentally. It is shown that the cylindrical microlens method combined with the method of two spherical lenses provides for high-efficiency (60 percent) coupling, with low requirements for the precision of element alignment for lasers with significant asymmetry of the radiation pattern. A coupling efficiency of 40 percent, with a coupled power of 0.2-0.4 mW, has been demonstrated experimentally.

**A91-11948** Passive mode locking in a laser with a nonreciprocal nonlinear loop reflector (Passivnaia sinkhronizatsiia mod v lazere s nevzaimnym nelineinym petlevym otrazhatel'm). A. G. BULUSHEV, E. M. DIANOV, and O. G. OKHOTNIKOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 16, June 12, 1990, pp. 84-88. 6 Refs.

A single-resonator laser scheme is proposed in which passive mode locking is performed by a nonlinear-optic fiber loop reflector. This mode-locking scheme is free of problems connected with the maintenance of locking between coupled resonators and shows potential for the generation of short pulses in fiber-optic lasers. Since the optical-pulse parameters depend on the nonreciprocal phase, this laser can be used as a magnetic-field or rotation sensor.

**A91-22999 Mutual influence of the parametric effects and stimulated Raman scattering in optical fibers.** EKATERINA GOLOVCHENKO, PAVEL V. MAMYSHEV, ALEKSEI N. PILIPETSKII, and E. M. DIANOV, *IEEE Journal of Quantum Electronics* (ISSN 0018-9197), Vol. 26, Oct. 1990, pp. 1815-1820. 13 Refs.

The effect of Raman gain parametric suppression is investigated both theoretically and experimentally. Good agreement between theory and experiment is obtained. The analysis of the effect of Raman nonlinearity on the process of modulational instability in the region of negative group velocity dispersion of fibers is presented. New dependencies for the modulational instability frequency and increment are calculated.

**A91-17096 Design characteristics of multimode fiber-optic gyroscopes (Konstruktivnye osobennosti mnogomodovykh volokonno-opticheskikh giroskopov).** S. L. GALKIN and V. A. NIKOLAEV, *Priborostroenie* (ISSN 0021-3454), Vol. 33, April 1990, pp. 50-54. 13 Refs.

Some specific design features of multimode fiber-optic gyroscopes, that are aimed at achieving the highest possible precision, are examined. In particular, attention is given to the selection of the optimum emission source wavelength, directional coupler design, and configuration of the optical part of the gyroscope. Results of experimental studies of different fiber-optic gyroscope designs are presented.

**A91-17049 The optics of X-ray waveguides (Optika rentgenovodov).** R. P. DZHANGOBEGOV, *Akademiia Nauk Gruzinskoi SSR, Soobshcheniia* (ISSN 0132-1447), Vol. 138, June 1990, pp. 529-532. 7 Refs.

The principles of X-ray propagation through fiber waveguides are discussed. Such X-ray waveguides makes it possible to bend radiation, to focus, to defocus, and to collimate convergent and divergent X-ray beams.

**A90-52394 Optimization of the parameters of fluoride-glass fiber-optic waveguides in the mid-infrared range (Optimizatsiia parametrov odnomodovykh volokonnykh svetovodov iz fluoridnykh stekol dlia srednego infrakrasnogo diapazona).** V. G. PLOTNICHENKO and L. A. FRENKEL', *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 35, Aug. 1990, pp. 1730-1738. 17 Refs.

Refractive-index profiles for single-mode fluoride-glass optical fibers are determined which assure matching of zero-dispersion wavelengths and minimum losses. In contrast to the case of quartz-glass fibers, a first-order zero chromatic dispersion can be obtained simultaneously at several wavelengths for such fibers, corresponding to loss minima. Attenuation due to various irregularities in the fiber is also investigated, and it is shown that all types of losses in the fluoride-glass fiber are determined by the size of the lower-mode spot.

**A90-52350 Shaping of the spatial directivity characteristics of transmitting antenna arrays with a fiber-optic signal distribution system (Formirovanie prostranstvennykh kharakteristik napravlenosti peredaiushchikh AR s volokonno-opticheskoi sistemoi raspredeleniia signalov).** A. N. BRATCHIKOV, A. I. KUKSHIN, E. S. PUZAKOV, and V. V. SAVIN, *Radioelektronika* (ISSN 0021-3470), Vol. 33, Aug. 1990, pp. 95-97. 9 Refs.

Various designs of waveguide processors with correlation holographic processing of analog signals are considered. It is shown that the base of processed signals in these devices can reach a value of about 10,000. The possibility of using focusing waveguide holograms as matched holographic filters is considered. Finally, results of an investigation of the correlation processing of signals from multimode fiber-optic sensors are presented.

**A90-50856 High-frequency magneto-optics of fiber-optic waveguides (Vysokochastotnaia magnitooptika volokonnykh svetovodov).** S. N. ANTONOV, A. N. BULIUK, P. M. VETOSHKO, and G. N. SHKARDIN, *Kvantovaiia Elektronika* (ISSN 0368-7147), Vol. 17, July 1990, pp. 829-834. 8 Refs.

RF distributed magneto-optical interaction associated with the Faraday effect is investigated for fiber-optic waveguides (FOWs) in the case when conditions of spatial and temporal synchronism between the waveguide eigenmodes and the external magnetic field are satisfied. Analytical expressions are obtained which describe the basic relationships of the light-polarization-state modulation in a long FOW at radio and microwave frequencies. Several realizations of the RF magneto-optical modulator are considered, and in particular it is shown that if a quartz FOW 10 m long and wound as a cylindrical coil is placed into a coaxial microwave cavity, the microwave control power will amount to 10 W at a light modulation efficiency of 50 percent.

**A90-34621 A study of a fiber-optic polarizer with a metal film and a dielectric buffer layer (Issledovanie volokonno-opticheskogo polarizatora s metallicheskoii plenkoi i dielektricheskimi bufernymi sloem).** V. M. GELIKONOV, D. D. GUSOVSKI, I. N. KONOPLEV, V. I. LEONOV, I. A. MAMAEV et al., *Kvantovaiia Elektronika* (ISSN 0368-7147), Vol. 17, Jan. 1990, pp. 87-89. 14 Refs.

The attenuation coefficients of TM<sub>0</sub> and TE<sub>0</sub> modes in a fiber-optic polarizer with a metal film and two dielectric buffer layers, one of which is a residual part of the cladding, are investigated theoretically using a model of a planar layered waveguide. At wavelengths of 0.63 and 0.85 micron, polarizers with a buffer layer of magnesium fluoride and an aluminum film, with extinction coefficients of 53 and 46 dB, respectively and losses less than 0.5 dB, have been realized experimentally.

**A90-50851 A new method for obtaining fiber-optic waveguides doped with rare earth elements (Novyi metod polucheniia volokonnykh svetovodov, legirovannykh redkozemel'nymi elementami).** A. A. ABRAMOV, M. M. BUBNOV, A. E. VORONKOV, A. N. GUR'IANOV, G. G. DEVIATYKH et al., *Kvantovaiia Elektronika* (ISSN 0368-7147), Vol. 17, July 1990, pp. 813, 814. 9 Refs.

A novel technique is proposed for the production of fiberoptic waveguides activated by various rare-earth ions. This technique is based on vapor-phase axial deposition and employs organometallic compounds of rare-earth elements. This process makes it possible to fabricate low-loss single-mode and multimode active lightguides. The proposed technique is particularly suitable in the case of doping with several coactivators.

**A90-44665 Photoinduced second-harmonic generation in gamma-ray-irradiated optical fibers.** E. V. ANOIKIN, E. M. DIANOV, P. G. KAZANSKII, and D. I. STEPANOV, *Optics Letters* (ISSN 0146-9592), Vol. 15, Aug. 1, 1990, pp. 834, 835. 10 Refs.

Evidence is presented on photoinduced second-harmonic generation (SHG) in optical fibers irradiated by gamma rays. Data are presented showing that, as a result of exposure of Ge and (Ge + Ce) fibers to gamma rays (from Co-60, at a dose of 10 to the 6th rad and with a rate of 400 rad/sec), the SHG convergence efficiency in these fibers increased by a factor of 20. The increase is explained on the basis of SHG induction by a photovoltaic mechanism.

**A90-42925 Effect of optical polarization on the operation of a laser Doppler anemometer. I (Vliianie polarizatsii sveta na rabotu lazernogo doplerovskogo anemometra. I).** B. S. RINKEVICHIIUS, A. V. STEPANOV, and A. V. TOLKACHEV, *Priborostroenie* (ISSN 0021-3454), Vol. 33, March 1990, pp. 82-86. 5 Refs.

Relationships are obtained for analyzing the effect of the light-polarization characteristics in an LDA system on the characteristics of the Doppler signal. Ways to compensate for polarization effects in the LDA are examined.

**A90-37847 A fiber-optic sound transducer (Optovolonnyy datchik zvuka).** E. S. AVDOSHHIN, *Avtometriia* (ISSN 0320-7102), Jan.-Feb. 1990, pp. 34-38. 9 Refs.

The design of an acoustic transducer with a vibrating multimode waveguide is described. The transducer elements are calculated, and experimental data are presented on the performance characteristics of a transducer with a modulation depth of sound-induced optical emission of not less than 20 percent in the frequency range 100-5000 Hz. It is noted that the transducer described here is suitable for use in optical data transmission systems.

**A90-34653 Effect of temperature on the backscattering signal in high-aperture fiber-optic waveguides (Vliianie temperatury na signal obratnogo rasseianiia v vysokotemperaturnykh volokonnykh svetovodakh).** V. V. GRIGOR'YANTS, G. A. IVANOV, V. A. ISAEV, E. D. ISAIKINA, O. R. MAMEDLI et al., *Kvantovaiia Elektronika* (ISSN 0368-7147), Vol. 17, March 1990, pp. 378-380. 6 Refs.

A study is made of the effect of heating in the temperature range 20-900 C on losses and backscattering signal in quartz fiber waveguides with cores of SiO<sub>2</sub>-GeO<sub>2</sub>-P<sub>2</sub>O<sub>5</sub> and SiO<sub>2</sub>-GeO<sub>2</sub>. The temperature sensitivity of the backscattering signal is found to be 0.00033 dB/C in the range 20-750 C and 0.0001 dB/C in the range 20-850 C. In fiber-optic waveguides with a core of SiO<sub>2</sub>-GeO<sub>2</sub>-P<sub>2</sub>O<sub>5</sub>, an irreversible increase in the backscattering signal is observed during heating, whose magnitude is determined by the maximum heating temperature.

**A90-34647 Luminescence, scattering, and absorption of light in quartz optical fibers and prospects for their use in distributed waveguide transducers (Luminestsentsiia, rasseianie i pogloschenie sveta v kvartsevykh opticheskikh volonakh i perspektivy ikh ispol'zovaniia v raspredelennykh svetovodnykh datchikakh).** B. G. GORSHKOV, I. E. GORBATOV, I. K. DANILEIKO, and A. V. SIDORIN, *Kvantovaiia Elektronika* (ISSN 0368-7147), Vol. 17, March 1990, pp. 345-350. 27 Refs.

Scattering, photoluminescence, and infrared absorption in quartz optical fibers are investigated theoretically and experimentally. Temperature dependences of the intensities of Raman and Brillouin scattering and photoluminescence are obtained for different wavelengths of the excitation emission. Determinations are also made of the transmission spectra of the optical fibers in the IR region at various temperatures. It is found that the frequency shift of Brillouin scattering increases in the case of the longitudinal stretching of the waveguide. The possibility of the fabrication of distributed fiber-optic transducers with various physical parameters is examined in the light of the study results.

**A90-29177 Quantum squeezed states in optical solitons (Kvantovye szhatye sostoiianiia v opticheskikh solitonakh).** A. V. BELINSKII and A. S. CHIRKIN, *Kvantovaiia Elektronika* (ISSN 0368-7147), Vol. 16, Dec. 1989, pp. 2570-2572. 11 Refs.

A quantum theory of optical-soliton propagation in optical fibers is developed on the basis of the continuum-integral formulation of the nonlinear Schroedinger equation. It is shown that fluctuations of one of the quadrature components of a soliton can be reduced; in the optimal case, the suppression efficiently increases with increasing distance. Deep squeezing is found to be achievable.

**A90-34618 Matching of fiber-optic and strip waveguides by means of gradient-index optical elements (Soglasovanie volokonnykh svetovodov i poloskovykh opticheskikh volnovodov s pomoshch'iu gradientnykh opticheskikh soglasuiushchikh elementov).** A. V. SHMAL'KO, M. R. GORDOVA, V. F. LAMEKIN, I. V. NIKOLAEV, V. V. SAKHAROV et al., *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 17, Jan. 1990, pp. 75-79. 11 Refs.

A procedure is presented for selecting and calculating the parameters of axisymmetric anamorphote gradient-index lenses for the optical matching of single-mode fiber-optic waveguides and optical strip waveguides with increased tolerances on the mutual arrangement of the matching elements. A mockup of an optical matching element based on gradient-index lenses is investigated experimentally.

**A90-21749 Self-switching of radiation in a two-core optical fiber with separation of the cores at the fiber ends (Samoperekliuchenie izlucheniia v dvuzhii'nom volokonnom svetovode s razvedennymi zhiilami na kontsakh).** E. M. DIANOV, A. V. KUZNETSOV, A. A. MAIER, O. G. OKHOTNIKOV, K. I. U. SITARSKII et al., *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 309, No. 3, 1989, pp. 611-614. 15 Refs.

Experimental results are reported on the possibility of radiation self-switching in a tunnel-coupled optical waveguide (TCOW) having the form of a two-core optical fiber with the cores separated at the fiber ends. Ultrashort pulses from a passively mode locked laser at a wavelength of 1.06 micron were injected into the waveguide. Self-switching of radiation in this TCOW was positively identified.

**A90-19278 Stimulated four-photon nonlinear processes and parametric solitons in fiber-optic waveguides (Vynuzhdennye chetyrehfotonnye nelineinye protsessy i parametricheskie solitony v volokonnykh svetovodakh).** L. M. KOVACHEV and V. N. SERKIN, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Sept. 1989, pp. 1881-1884. 10 Refs.

The possibility of the formation of parametrically related dark and light optical solitons during stimulated four-photon parametric processes in fiber-optic waveguides is demonstrated. It is found that pulse generation during stimulated four-photon parametric processes is unstable in the absence of full synchronism. The role of stimulated four-photon processes in the generation of the higher Stokes components of stimulated Raman scattering is investigated, and it is shown that four-photon processes provide a way to control the generation of combination solitons.

**A90-17197 Excitation of high-power pulses in a fiber ring interferometer (Vozbuzhdenie moshchnykh impul'sov v volokonnom kol'tsevom interferometre).** A. G. BULUSHEV, E. M. DIANOV, A. V. KUZNETSOV, O. G. OKHOTNIKOV, and V. M. PARAMONOV, *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, Oct. 12, 1989, pp. 48-52. 5 Refs.

The increase of the power of an optical pulse in a fiber ring interferometer was investigated experimentally using a semiconductor laser with an external cavity generating at 1.32 micron as the source and a single-mode fiber-optic waveguide as the coupling. It is shown that the increase in the power of the pulses in the fiber ring interferometer makes it possible to observe nonlinear effects in the waveguide for a relatively low input power. This mechanism can be used, in particular, to achieve phase self-modulation of the pulse in the ring interferometer prior to pulse compression.

**A89-49361 The influence of transverse hypersonic inhomogeneity on the SBS radiation spectrum in single-mode optical fibers (Vliianie poperechnoi giperzvukovoi neodnorodnosti na spektr izlucheniia VRMB v odnomodovnykh volokonnykh svetovodakh).** E. M. DIANOV, A. IA. KARASIK, A. V. LUCHNIKOV, A. N. PILIPETSKII, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, April 1989, pp. 752-756. 10 Refs.

In silica-glass fibers, in addition to optical transverse inhomogeneity, transverse inhomogeneity of a hypersonic wave occurs and is responsible for the SBS process. In a single-mode waveguide with antiwaveguide hypersound propagation, considerable broadening of the SBS spectrum is observed, compared to the homogeneous nonwaveguide medium. During this broadening, the SBS bandwidth depends weakly on the pump pulse duration and is determined by the character of the transverse hypersonic inhomogeneity. For a fiber with a central gap in the refractive index profile, experimental results of bandwidth measurement are in satisfactory agreement with theoretical calculations.

**A89-49358 Narrowing of an injection laser line by resonant Rayleigh scattering from a fiber ring interferometer (Suzhenie linii inzhektionsionnogo lazerarezonansnym relevskim rasseianiem iz volokonnnogo kol'tsevoogo interferometra).** A. G. BULUSHEV, E. M. DIANOV, A. V. KUZNETSOV, and O. G. OKHOTNIKOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, April 1989, pp. 733-736. 8 Refs.

Consideration is given to fiber-optic devices serving as elements of the resonator optics of semiconductor lasers. A Mach-Zehnder interferometer and a ring interferometer are used as examples to show the effectiveness of fiber-optic methods for mode discrimination and narrowing of a lasing line. A semiconductor laser with an external fiber resonator is studied, which emits at a 1.58-micron wavelength and uses resonant Rayleigh scattering in a ring fiber interferometer. Narrowing of the laser radiation line by more than 2000 times is achieved. A mechanism for reducing the value of frequency fluctuations due to Rayleigh scattering in the ring interferometer is discussed.

**A90-14548 Effective matching of a microwave modulator with a laser diode in a prescribed band of the GHz region (Effektivnoe soglasovanie SVCh modulirovatora s lazernym diodom v zadannoi polose chastot gigagertsevogo diapazona).** A. A. BLISKAVITSKII, I. U. K. VLADIMIROV, I. U. A. TAMBIEV, and N. V. SHELKOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Aug. 1989, pp. 1751-1754. 8 Refs.

Aspects of the broadband low-loss matching of an InGaAsP heterostructure laser and a microwave modulator in the GHz region were studied theoretically and experimentally. Results of panoramic measurements of the laser SWR are used to estimate elements of its equivalent circuit and to synthesize a passive microstrip matching circuit. This circuit makes it possible to raise the efficiency of the laser-radiation-intensity modulation by more than 10 dB in the modulating frequency band from 2 to 3.4 GHz.

**A90-12455 The differential Doppler velocimeter with a fiber-optic-lightguide and a miniature emitting probe head (Differentsial'nyi doplerovskii izmeritel' skorosti s volokonnyim traktom i miniatiurnoi izluchaushchei golovkoi zonda).** S. N. KHOTIAINTSEV and L. K. IAROV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, June 1989, pp. 1273-1278. 6 Refs.

A novel scheme for a miniature probe head for a fiber-optic differential-type laser Doppler velocimeter (LDV) is described. Analytical relationships are derived for LDV parameters in the case of optical adjustment. The effect of the lightguide radiation mode structure on the characteristics of the LDV probing field is considered. The feasibility of adjusting the interference field period while obtaining velocity measurements is demonstrated.

**A90-12369 Fiber-optic sensor of the spatial coherence of radiation (Volokonno-opticheskii datchik prostranstvennoi kogerentnosti izlucheniia).** D. V. BARANOV, M. I. BELOVOLOV, I. V. ZHURIOVA, S. K. ISAEV, A. P. KRIUKOV et al., *Moskovskii Universitet, Vestnik, Seriya 3—Fizika, Astronomiia* (ISSN 0579-9392), Vol. 30, July-Aug. 1989, pp. 61-64. 15 Refs.

A simple and compact sensor of spatial coherence is described which is based on a Y-type fiber-optic directional coupler. The signal at the sensor output is produced as the result of the interference of light beams trapped by the fiber cores. The sensor makes it possible to spread the plane of the beam as well as the recording equipment, to use electronic signal processing, and to measure the curvature radii of the laser-beam wavefronts.

**A90-10967 Theory of photoinduced second harmonic generation in fiber-optic waveguides (K teorii fotoindutsirovannoi generatsii vtoroi garmoniki v volokonnykh svetovodakh).** E. M. DIANOV, A. M. PROKHOROV, V. O. SOKOLOV, and V. B. SULIMOV, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 50, July 10, 1989, pp. 13, 14. 9 Refs.

A mechanism for photoinduced second harmonic generation in fiber-optic waveguides made of quartz glass is proposed which is based on the formation of an orientation order in a system of defects characterized by second-order local susceptibility. The interaction between the defects considered here is similar, in a certain sense, to the van der Waals interaction between atoms and molecules. The principal difference is the nature of the electromagnetic field that induces the dipole moments: in the present case, it is the pumping wave field, whereas in the case of van der Waals interaction, it is the fluctuation vacuum field.

**A89-53715 All-fiber sensor of angular velocity (Tsel'novolokonnyi datchik uglovoi skorosti vrashcheniia).** A. TS. ANDREEV, O. A. VLASENKO, E. M. DIANOV, G. L. DIANKOV, B. S. ZAFIROVA et al., *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (ISSN 0320-0116), Vol. 15, June 26, 1989, pp. 85-88. 6 Refs.

The paper reports the construction of an all-fiber optical sensor of angular velocity whose operation is based on the Sagnac effect in a fiber ring interferometer. An all-fiber system does not require the use of external discrete optical elements; division, polarization, and modulation functions are performed by the fiber waveguide itself. The fiber elements and sensor are constructed on the basis of slightly anisotropic fiber waveguides. The sensitivity of the device was 0.0077 deg/sq rt hr, while the zero drift was 0.5 deg/hr.

**A89-35780 Efficient compression of high-energy laser pulses.** E. M. DIANOV, LUBEN M. IVANOV, PAVEL V. MAMYSHEV, and A. M. PROKHOROV, *IEEE Journal of Quantum Electronics* (ISSN 0018-9197), Vol. 25, April 1989, pp. 828-835. 40 Refs.

Limitations caused by stimulated Raman scattering (SRS) for laser pulse compression in traditional fiber-grating compressors are discussed. It is shown that the scheme utilizing fibers of length  $L$  exceeding the length of the dispersion walk off  $L(\text{walk off})$  of pump pulses and SRS permits one to obtain high-contrast compressed pulses, their energy being no more than a few nJ, and the ultimate width being proportional to the square root of the initial pulse width. For the compression utilizing fibers of length  $L$  less than  $L(\text{walk off})$ , the pulse energies are not limited, but the compression factor is limited to the value of 32, and the compressed pulses have a low-intensity wide pedestal. A theoretical model of high-energy pulse compression with simultaneous pedestal suppression by the polarization technique using nonlinear birefringence of the fiber is discussed. This technique is compared to the spectral windowing technique.

**A89-53705** Acoustic pulse propagation during induced acoustic coflow interaction in fiber-optic waveguides (Rasprostraneniye akusticheskikh impul'sov pri poputnom vyzhdenom akusticheskoy zaimodeistvii v volokonnykh svetovodakh). A. I. GURINOVICH, V. V. ZOSIMOV, L. M. LIAMSHV, and A. V. PANASIUK, *Akademiia Nauk SSSR, Izvestiia, Seriya Fizicheskaya* (ISSN 0367-6765), Vol. 53, Aug. 1989, pp. 1520-1523. 9 Refs.

The objective of the study was to develop and analyze alternative methods of the formation of femtosecond solitons from picosecond N-soliton pulses. The approach used here is based on the idea that, by feeding superposed multisoliton and perturbation pulses into a fiber-optic waveguide, it is possible to stimulate the pulse decomposition process and thus separate a soliton of minimum duration. The discussion focuses on the optimal characteristics of the perturbation pulse and the ratio of the induced and spontaneous decomposition lengths.

**A89-46431** Fiber-optic Fabry-Perot interferometers with single-mode and graded-index lightguides (Volokonnye inetrferometry Fabri-Pero na odnomodovykh i gradientnykh svetovodakh). D. V. BARANOV, I. V. ZHURLOVA, S. K. ISAEV, L. S. KORNENKO, and A. A. SACHKOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, May 1989, pp. 1064-1067. 10 Refs.

A simple technique for the mass production of fiber-optic Fabry-Perot interferometers featuring high resolving power and a spectrum scanning period of the order of dozens of microsec is described. Experimental results are presented on the transverse structure of radiation at the waveguide output before and after mirror deposition.

**A89-46424** Mode structure of the Stokes components of forward SRS in optical fibers (Modovaia struktura stoksovykh komponent poputnogo VKR v opticheskikh voloknakh). E. A. KUZIN, M. A. MAKSIUTENKO, V. I. MARAKHONOV, and V. V. SPIRIN, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, May 1989, pp. 1026-1031. 9 Refs.

The mode structure of the Stokes components in multimode SiO<sub>2</sub>:GeO<sub>2</sub> glass and capillary optical fibers was studied experimentally. It is shown that the prevailing amplification of the fundamental mode in graded-index glass fibers results in an anomalous reduction of the thresholds of the higher-order Stokes components and in their propagation only in the fundamental mode of the fiber. The complex ring structure of the far-field Stokes wave in step-index glass fibers is connected with the possibility of the matching of the group velocities of the pump and the scattered wave in nonideal step-index fibers.

**A89-40770** The effective compression of high-energy laser pulses in fiber-grating compressors (Effektivnoe szhatie vysokoenergetichnykh lazernykh impul'sov v volokonno-reshetochnykh kompressorakh). E. M. DIANOV, L. M. IVANOV, P. V. MAMYSHEV, and A. M. PROKHOROV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, Feb. 1989, pp. 298-300. 12 Refs.

A simple theoretical model describing the joint action of phase self-modulation and nonlinear birefringence on laser pulse propagation along an optical waveguide is proposed. The use of these two effects makes it possible to effectively compress the high-energy laser pulses whose energy exceeds the energies which can be achieved under pulse compression in conventional schemes by three orders of magnitude.

**A89-49342** Tunable picosecond and femtosecond sources of quasi-CW laser radiation based on fiber-optic converters (Perestraivaemye piko- i femtosekundnye istochniki kvazinepreryvnogo lazernogo izlucheniia na baze volokonno-opticheskikh konvertorov). S. A. AKHMANOV, D. N. DOVCHENKO, N. I. ZHELUDEV, A. V. SIMONOV, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 16, April 1989, pp. 649-651. 5 Refs.

Results are presented on the development of a new family of completely solid-state frequency-tunable CW laser sources that emit in the picosecond and femtosecond bands. The laser sources are based on the principle of nonlinear frequency conversion and dispersive compression of the spectral continuum radiation.

**A89-44993** Middle-infrared chalcogenide glass fibers with losses lower than 100 dB/km. E. M. DIANOV, V. G. PLOTNICHENKO, G. G. DEVIATYKH, M. F. CHURBANOV, and I. V. SKRIPACHEV, (Eidgenossische Technische Hochschule Zuerich, International Conference on Infrared Physics, 4th, Zurich, Switzerland, Aug. 22-26, 1988) *Infrared Physics* (ISSN 0020-0891), Vol. 29, May 1989, pp. 303-307. 17 Refs.

The preparation and optical and mechanical characteristics of As(0.4)S(0.6), As(0.35)Se(0.65), and Ge(0.05)As(0.38)Se(0.57) glass fibers are reported. The fibers were prepared by the crucible method, as described by Vasiliev et al. (1988) and characterized experimentally in terms of optical losses as a function of wavelength, weak absorption, and photoinduced absorption. Fibers of diameter 400 microns and length 10-50 m are found to have mean bending strength of 500-700 MPa and minimum optical losses of 44-46 dB/km at 2.45-2.55 microns (AsS), 76-80 dB/km near 4 microns (AsSe), and 98 dB/km at 2.7 microns (GeAsSe).

**A89-42639** Spectral-modulation characteristics of injection lasers with selective resonators for application in fiber-optic communication systems (Spektral'no-modulatsionnye kharakteristiki inzhetsionnykh lazerov s selektivnymi rezonatorami dlia VOLS). K. B. DE-DUSHENKO and S. A. EGOROV, *Radiotekhnika* (ISSN 0033-8486), April 1989, pp. 78-80. 9 Refs.

The paper presents an experimental study of the spectral characteristics of semiconductor injection lasers with a short internal resonator and an external dispersion resonator in the case of deep pulse modulation. Experiments were performed on a stripe-contact double-heterostructure GaAlAs laser, emitting at 0.88 micron. It is shown that the use of internal and external resonators leads to a narrowing of the lasing band of the semiconductor laser in the case of pulse modulation.

**A89-35560** Fiber-optic systems for distributing and processing antenna-array signals (Review) (Volokonno-opticheskie sistemy raspredeleniia i obrabotki signalov antennykh reshetok /Obzor/). A. N. BRATCHIKOV and A. I. GRINEV, *Radioelektronika* (ISSN 0021-3470), Vol. 32, Feb. 1989, pp. 19-31. 50 Refs.

The current status and future prospects of the use of fiber-optic and integrated-optics system for distributing and processing antenna array signals are considered. Particular attention is given to systems of amplitude-phase calibration, distributed-feedback systems, optical processors for phased-array antenna beam formation, a fiber-optic channel with intensity modulation, a receiving array with combined modulation, and an array with digital modulation.

## Japanese Aerospace Literature This month: *Satellite Communications*

**A91-21274** Japanese terrestrial and satellite broadcasting technology - Present and future. EIICHI SAWABE, *Space Communications* (ISSN 0924-8625), Vol. 8, Dec. 1990, pp. 31-35. 12 Refs.

In status rainfall events, the effects of ice depolarization are evaluated using the CS-2 beacon signal and X-band radar observations. Although the ice effects described in terms of the deviation from theoretical rain depolarization show a large variation according to the rain height, net ice depolarizations deduced above this height are relatively constant.

**A91-14153** Multibeam system applications and impact on satellite communications. MAKOTO KAWAI and KENJI NAKAYA, IAF 41st International Astronautical Congress, Dresden, Federal Republic of Germany, Oct. 6-12, 1990. 6 pp. 7 Refs. (IAF Paper 90-458).

This paper describes the system concept of a millimeter-wave personal satellite communications system for the first decade of the 21st century. Using millimeter-wave frequency bands and an onboard processor with baseband switching, an advanced satellite communications system can be built. Subscribers will access the satellite directly from ultrasmall earth stations, like the portable terminals used in existing cellular systems. Efficient channel assignment and routing will be done onboard the satellite, and subscribers can use the system at a reasonable charge for personnel. With the conventional satellite system advantages of coverage and flexibility, this system will offer very convenient communications services that can be utilized for various applications.

**A90-34027** 14/12-GHz-band satellite communication services. KUNIHITO HAYASHI, KIYOAKI NAGAKI, and YASUO MORI, *NTT Review* (ISSN 0915-2334), Vol. 2, Jan. 1990, pp. 44-52. 13 Refs.

An analysis is presented of the traffic performance of a variable-channel-per-burst (VCPB) satellite-switched time-division multiple access (SS-TDMA) that dynamically reconfigures traffic bursts. An SS-TDMA system with an onboard baseband switch is used as the VCPB application system. Bursts are assigned to each earth station one-by-one. Idle channels of other bursts are transferred to a burst having an insufficient number of idle channels by reconfiguration on a call-by-call basis. The VCPB is suited to SS-TDMA systems with relatively few earth stations. VCPB traffic performance depends on the reconfiguration strategy. The effects on traffic performance caused by reallocating idle channels to all bursts in every reconfiguration are described. Reconfiguration probability, defined as the ratio of the number of calls connected by reconfiguration to the total number of calls, is the most important factor in VCPB system traffic performance and can be reduced by reallocation. An approximate formula for the reconfiguration probability from the loss probability of fixed-channel-per-burst (FCPB) TDMA weighted by the binomial distribution for the number of channels in each burst is derived. The approximate reconfiguration probability is close to that of the simulation using reallocation. Reconfiguration process delay time deteriorates channel utilization efficiency. The reconfiguration probability decrease caused by reallocation increases channel utilization efficiency.