

A88-11359 Radio-holographic determination of the longitudinal size of ionospheric irregularities (Opređenje prodol'nykh razmerov ionosfernykh neodnorodnostei s pomoshch'iu radiologograficheskogo metoda). E. D. TERESHCHENKO and V. G. UTKIN, *Geomagnitizm i Aeronomia* (ISSN 0016-7940), Vol. 27, July-Aug. 1987, pp. 572-575. 5 Refs.

Analytical expressions describing the hologram and the holographically reconstructed field are obtained for a model of an irregularity which has the form of a layer with a constant density in the direction of radio-wave incidence and which varies in the transverse direction according to the Gaussian law. It is shown that if the characteristic size of the scatterer is such that the geometrical-optic approximation can be used to describe the field propagation process within the irregularity, then the longitudinal size of the scatterer can be determined from the holographic reconstruction.

A87-43553 A holographic grazing-diffraction selector-telescope (Golograficheskii selektor-teleskop skol'ziashchei difraktsii). M. V. VASNETSOV, I. G. SOKOLOVA, M. S. SOSKIN, and V. B. TARANENKO, *Kvantovaya Elektronika* (ISSN 0368-7147), Vol. 14, March 1987, pp. 597-602. 14 Refs.

The holographic recording of phase-volume gratings on dichromated gelatin films designed for operation in a grazing-incidence scheme is studied. Some features of grazing diffraction by phase-volume gratings are discussed. The achieved diffraction efficiency amounts to about 30 percent at an 88-deg angle of incidence.

A87-35977 Selective holography (Analytical review) (Selektivnaia golografiia /Analiticheskii obzor/). E. N. VORONIN, *Radioelektronika* (ISSN 0021-3470), Vol. 30, Feb. 1987, pp. 16-32. 33 Refs.

The theoretical principles and practical applications of selective microwave and acoustical holography are reviewed. Particular consideration is given to the formalization of the recording process using M-position coherent detectors, the principle of contrast material; the formation of reconstruction algorithms, microwave tomography, adaptive vision systems, and antenna measurements.

A87-41796 Use of a parabolic equation to solve the problem of image reconstruction by heterodyne holography (Ispol'zovanie parabolicheskogo uravneniia dlia resheniia zadachi vosstanovleniia izobrazheniia metodom geterodinnoi golografi). A. N. MANSUROV and G. A. SHADRIN, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 32, April 1987, pp. 881-883.

It is shown that two-step image reconstruction using heterodyne holography can be described by a convolution integral which is similar to the Kirchhoff diffraction integral in the Fresnel approximation. Image reconstruction in this case can therefore be viewed as the result of linear filtering carried out in the signal conversion process with its own impulse and frequency response.

A87-50867 The use of multilayer structures for recording thin phase holograms (Ispol'zovanie mnogosloinnykh struktur dlia zapisi tonkikh fazovykh gologramm). D. I. MIROVITSKII, N. V. ROSTOVTSOVA, and O. B. SEROV, *Avtometriia* (ISSN 0320-7102), May-June 1987, pp. 92-100. 8 Refs.

Phase diagrams recorded on thin spatially separated photosensitive layers are investigated theoretically and experimentally. It is shown that such multilayer structures are characterized by high spectral and angular selectivity and that their diffraction efficiency is close to that of three-dimensional holograms. However, the use of holograms with the number of layers exceeding four is not recommended since the increased diffraction efficiency is offset by increasing absorption and multiple layer reflection.

A88-13677 Extension of holography to multifrequency fields (Rasshirenie golografiia na mnogochastotnye polia). N. B. BARANOVA and B. I. A. ZEL'DOVICH, *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (ISSN 0370-274X), Vol. 45, June 25, 1987, pp. 562-565. 10 Refs.

Experiments are described which demonstrate the possibility of extending holographic processes to the cases of (1) recording of the interference patterns of mutually coherent fields of several different frequencies and (2) recording of the perturbations of higher-order optical susceptibilities. These processes are examined in relation to second harmonic generation in waveguides.

A89-35559 Applications of tomography in microwave technology (Review) (Primeneniia tomografii v mikrovolnovoi tekhnike /Obzor/). D. I. VOSKRESENSKII, E. N. VORONIN, and R. P. KAMINSKII, *Radioelektronika* (ISSN 0021-3470), Vol. 32, Feb. 1989, pp. 4-18. 50 Refs.

Techniques of classical and computer tomography are examined with reference to the solution of a large class of inverse radio and acoustic sounding problems. Applications of tomography to the introspection of radio-transparent and acoustically transparent structures are discussed. Attention is also given to nontraditional applications of tomography, i.e., selective radio-acoustic imaging, superhigh-resolution radiohydrolocation, and radio astronomy.

A89-18369 Image quality enhancement for a holographic system with a circular receiving aperture (Ob uluchshenii kachestva izobrazhenii golograficheskoi sistemy s priemnoi aperturoi v vide okruzhnosti). A. CH. BELIACHITS, P. D. KUKHARCHIK, and V. G. SEMENCHIK, *Radiotekhnika i Elektronika* (ISSN 0033-8494), Vol. 33, Oct. 1988, pp. 2174-2177.

The paper examines the feasibility of improving the quality of reconstructed images for a holographic system with a circular receiving aperture by shifting the illuminating antenna along the circle. The main characteristics of this system are presented, and a comparison is made with another type of holographic system.

Japanese Aerospace Literature This month: Holography

A88-38958 Turbulent structure near the stagnation point of an axisymmetric impinging jet. KUNIO HIJIKATA and JYUNJI MIMATU, *Proceedings of the 6th Symposium on Turbulent Shear Flows*, Toulouse, France, Sept. 7-9, 1987, (A88-38951 15-34). University Park, PA, Pennsylvania State University, 1987, pp. 2-2-1 to 2-2-6. 8 Refs.

A visualization of the pressure field on a plate impinged by an axisymmetric turbulent air jet was carried out. The displacement of silicon rubber sheet which has settled on the impinged plate by the pressure of the jet was measured by a holographic interferometer. The fringes corresponded to instantaneous isobaric lines, or the contours of fluctuating pressure, on the plate. In order to know the physical meaning of the pressure fluctuation pattern, the cross-correlation between the fluctuations of the pressure on the impinged plate and the velocity in the jet was measured. The movement and destruction of the large eddy affecting the wall pressure were traced from a map of the contours of the correlations. It was clarified that spot and arc-shaped patterns in the visualization were generated by the eddy impingement and the induced velocity fluctuation due to the impingement, respectively.

A88-48206 A differential interference contrast system incorporating a Murty interferometer and holographic correction. K. MATSUDA, M. NAMIKI, and T. H. BARNES, *Optics and Lasers in Engineering* (ISSN 0143-8166), Vol. 9, No. 1, 1988, pp. 35-46. 6 Refs.

A differential interference contrast method for observing the phase gradients in objects with phase variations of less than 1/4 of a wavelength is described which incorporates a Murty-type interferometer consisting of a plane parallel glass plate. The basic system is modified using a holographic element both to compensate for lens aberrations and to modulate the output fringes to allow their easy detection. Film thickness measurements obtained with the present system are found to agree well with previous results.

A87-53167 Diagnosis of under-snow radar images by three-dimensional displaying technique in holographic imaging radar. YOSHINO AOAKI, YUJI SAKAMOTO, and YOSHINARI TAKAHASHI, *IGARSS '87 - International Geoscience and Remote Sensing Symposium*, Ann Arbor, MI, May 18-21, 1987, Digest Vol. 1 (A87-53101 24-43). New York, Institute of Electrical and Electronics Engineers, Inc., 1987, pp. 571-576. Research supported by the Suhara Memorial Foundation and MOESC. 9 Refs.

A technique to diagnose images obtained by under-snow radar is proposed, where three-dimensional radar images are displayed on a two-dimensional CRT scope of computer by the gray-level coding technique. The radar discussed in this paper is a holographic imaging radar and the azimuth information of objects is obtained by the ordinary holographic technique, whereas the depth information is obtained by frequency-sweep technique. An experiment was conducted with the microwaves from 8 GHz to 10 GHz frequency to visualize radar images of objects such as a container filled with anti-freeze water, metallic cans and a mannequin covered with silver papers which were buried under piled snow in winter. Discussion on the diagnosis of the numerically reconstructed radar images was done by changing the points of view of the screen on the CRT scope. The experimental results show the proposed technique is promising to construct a practical system of under-snow radar.

A88-30273 Advances in the laser speckle strain gauge. ICHIROU YAMAGUCHI, *Optical Engineering* (ISSN 0091-3286), Vol. 27, March 1988, pp. 214-218. 13 Refs.

Basic principles and advances of the laser speckle strain gage are described. The gage optoelectronically detects speckle displacements caused by deformation of a diffuse surface and separates strain by means of a differential optical system. The method is noncontacting and automatic. Several problems for practical application of the gage are presented, together with proposals for solving them.

A88-40372 Analysis of turbulent medium effects on holographic imaging. MITSUO TAKEIBA and YUICHI KAMEZAWA, *Kyushu University Technology Reports* (ISSN 0023-2718), Vol. 60, Dec. 1987, pp. 771-778.

A case is considered where the object, illuminated with a spatially partially coherent light, passes through a turbulent medium (II) and is recorded as a hologram using a long and a short exposure time. In this case, the partially coherent light is produced by propagation in another turbulent medium (I). Then the averages of the reconstructed images are given in analytic form and evaluated for a slit object. Both turbulent media reduce the intensity of the average reconstructed images but have no effect on the shape when the object wave is recorded using a long exposure time. If the object wave is recorded using a short exposure time, only the turbulent medium (II) reduces the intensity of the average reconstructed images and deforms the shape. The resolution of an object with three slits is also analyzed and found to significantly decrease in a strong turbulence of which the scale size is nearly equal to the diffracted pattern size of the object at the central position of the turbulent medium (II).

A88-29754 Aberrations in nonparaxial holography. KATSUYA GOTO and MIKIO KITAOKA, *Optical Society of America, Journal, A: Optics and Image Science* (ISSN 0740-3232), Vol. 5, March 1988, pp. 397-402. 11 Refs.

Analytical expressions are given for a reconstructed wave front from a hologram of a point object in a general holographic system. The locations of astigmatic images are found from the radii of principal curvature of the wave front. By using the expressions of the wave front, wave and ray aberrations are derived in which the second-order terms of the direction cosines of an object and a reference and also illuminating rays, each incident upon the origin, are taken into account. These aberrations are considered to be those of off-axis zone plates.

A88-29695 A hybrid real-time correlation system of aerial stereo photographs. R. T. HONG, J. TSUJIUCHI, N. OHYAMA, and T. HONDA, *Proceedings of the International Conference on Holography Applications*, Beijing, People's Republic of China, July 2-4, 1986, (A88-29688 11-35) Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, pp. 512-516.

A digital-optical hybrid system composed of a computer and a coherent optical filtering system is successfully applied to perform a real-time correlation of aerial stereo photographs. A LCLV (Liquid Crystal Light Valve) as an incoherent-to-coherent converter and a thermoplastic photoconductor material for holographic recording of MSF (Matched Spatial Filter) are used, and a sharp correlation peak with a good SNR is obtained.

A88-29693 Automatic processing of holographic interference fringes to analyze the deflection of a thin plate. S. TOYOOKA, Y. IWAASA, and H. NISHIDA, *Proceedings of the International Conference on Holography Applications*, Beijing, People's Republic of China, July 2-4, 1986, (A88-29688 11-35) Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, pp. 236-238.

Holographic interference fringes of deflection of a plate are automatically analyzed by spatial phase detection technique. The first and the second derivatives of deflection which are essential to stress analysis can be numerically derived from resultant phase distribution.

A88-14097 Antenna surface measurement by the holographic method using beacon signal of CS-2b satellite. TOSHIYUKI OKUYAMA, HAJIME FUKUCHI, KENJI NAKAMURA, and KEN'ICHI OKAMOTO, *Radio Research Laboratory Journal* (ISSN 0033-8001), Vol. 34, July 1987, pp. 71-83.

Measurements of the surface distortion of a 13-m diameter antenna at the Kashima Space Research Center Radio Research Laboratory were performed using the beacon signal of Japan's geostationary communications satellite CS-2b. The antenna surface distortion was calculated from the phase aperture distribution. The antenna surface accuracy obtained with the holographic method was in good agreement with that obtained with the optical method.

A89-49999 Holographic interferometric measurements of the three-dimensional temperature field with thermally developing flow in the measuring-beam direction. SEIZO KATO and NAOKI MARUYAMA, *Experimental Thermal and Fluid Science* (ISSN 0894-1777), Vol. 2, July 1989, pp. 333-340. 9 Refs.

An evaluation procedure of holographic interferograms is presented to determine the three-dimensional temperature field and the Nusselt number of a thermally developing convection flow in the direction of the measuring beam of a holographic interferometer. In analyzing the interferogram taken at an infinite fringe field adjustment, the thermal boundary layer developing along an isothermally heated wall is divided into equidistant infinitesimal sublayers where the respective refractive indices can be assumed to be constant. Thus the refractive index can be expressed as a step function. The ideal interferograms are then compensated by four additional fringe order shifts that occur in the real one - shifts due to light deflection and to heating of the inlet and outlet regions and of the transparent glass. The test section length is also adjusted so that the maximum corrected fringe order shift at the wall exactly corresponds to the wall temperature. The validity of this interferogram evaluation is confirmed by an experiment on the combined free and forced convection in the entrance region of a horizontal rectangular duct with constant wall temperature.

A87-48291 An experimental investigation of the stability of converging cylindrical shock waves in air. K. TAKAYAMA, H. KLEINE, and H. GROENIG, *Experiments in Fluids* (ISSN 0723-4864), Vol. 5, No. 5, 1987, pp. 315-322. 27 Refs.

An experimental study was made of the stability of converging cylindrical shock waves. The experiments were conducted on annular shock tubes equipped with a double exposure holographic interferometer in the Stosswellenlabor, RWTH Aachen, and in the Institute of High Speed Mechanics, Tohoku University, Sendai, for shock Mach numbers of 1.1 to 2.1 in air. By comparing these two different shock tube experiments, it is found that in the former facility the mode-three instability is predominant at the center of convergence, whereas the mode-four instability appears in the latter setup. The instabilities are denoted in this way because the shock and the flowfield behind it reveal a remarkable triangular and quadrangular symmetry, respectively. It is concluded that the converging cylindrical shock wave is always unstable and sensitive to the structure of the annular shock tube. The applicability of holographic interferometry to this kind of shock wave research is also demonstrated.

A87-39551 New high-resolution positive and negative photoresist method for lambda/4-shifted DFB lasers. M. OKAI, S. TSUJI, M. HIRAO, and H. MATSUMURA, *Electronics Letters* (ISSN 0013-5194), Vol. 23, April 9, 1987, pp. 370, 371. 6 Refs.

High-resolution positive and negative photoresists were used to fabricate lambda/4-phase-shifted corrugations by holographic exposure. To avoid mixing these photoresists, cyclized polyisoprene was used as a midlayer. The shape and depth of the corrugations on the positive and negative photoresist regions were almost the same. Single-mode operation at the Bragg wavelength was confirmed in lasers with the corrugation.

A90-10739 Multi-frame pulse holography system. YOSHITAKA YAMAMOTO, *Proceedings of the 18th International Congress on High Speed Photography and Photonics*, Xian, People's Republic of China, Aug. 28-Sept. 2, 1988, Part 2 (A90-10726 01-35) Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, pp. 587-594. 5 Refs.

Two methods for recording images with a framing holography system are proposed. In the first method, each pulse generated from multiple laser resonators is divided into two parts. Part of the beams illuminate the hologram from different directions as reference beams and the other beams illuminate the object as an object beam. In the other method, a pulse train-generated from a single laser resonator is divided into two parts so that some of the beams illuminate the object as an object beam while the others are used as reference beams. The incident angles of these reference beams are changes with pulses by electrooptical devices. Comparisons show that the first method is better if the number of recorded images is two or four.

A89-47737 Experimental learning in an optical perceptronlike neural network. HISAO YOSHINAGA, KEN-ICHI KITAYAMA, and TERUSHIGE HORI, *Optics Letters* (ISSN 0146-9592), Vol. 14, July 15, 1989, pp. 716-718. 7 Refs.

An optical perceptronlike neural network employing a delta learning rule and consisting of input units and a single output unit is constructed. Photorefractive crystals are used as holographic media for the interconnections between the input and the output layers. The learning rate for interconnection weight changes is optimally determined by setting the exposure time of the hologram. A learning experiment verifies the learning schedule's prediction that a fast, stable convergence of the learning process without oscillatory action can be obtained.

A89-43798 Experimental study of free vibration of clamped rectangular plates with straight narrow slots. KOICHI MARUYAMA and OSAMU ICHINOMIYA, *JSME International Journal, Series III* (ISSN 0914-8825), Vol. 32, June 1989, pp. 187-193.

The real-time technique of time-averaged holographic interferometry is applied to determine the natural frequencies and corresponding mode shapes of clamped rectangular plates with straight narrow slots, and the effect of the lengths, positions, and inclination angles of slots on the natural frequencies and corresponding mode shapes is investigated. Four types of slot locations for a slit parallel with respect to the sides of a plate and a slit having various inclination angles with respect to the longer sides are considered. The natural frequencies obtained experimentally are expressed in terms of a dimensionless frequency parameter, and the results are shown graphically as a function of dimensionless slit length and inclination angle.

A89-40887 Magnetic field observation of a single flux quantum by electron-holographic interferometry. TSUYOSHI MATSUDA, SHUJI HASEGAWA, MASUKAZU IGARASHI, TOSHIO KOBAYASHI, MASAYOSHI NAITO et al., *Physical Review Letters* (ISSN 0031-9007), Vol. 62, May 22, 1989, pp. 2519-2522. 19 Refs.

The magnetic lines of force of a single flux quantum (fluxon) penetrating a superconducting film (Pb) were observed directly and individually by the electron-holography technique using the Aharonov-Bohm effect. The phase contours of the electron wave not only confirm the quantized flux value $h/2e$ but also reveal, by phase amplification, internal structure of a single fluxon. With film thickness of 500 nm or less each fluxon, after penetrating the film, fans out or makes a U shape returning to another point on the film surface. With thicker films, fluxons form a bundle with a flux amounting to several times $h/2e$.

A87-37540 Systematic design method for holographic zone plates with aberration corrections. YUZO ONO and NOBUO NISHIDA, *Applied Optics* (ISSN 0003-6935), Vol. 26, March 15, 1987, pp. 1137-1141

Holographic zone plates have been reviewed and systematically summarized. For the generalized holographic zone plates proposed to correct aberrations in holographic laser scanners, the concept of origin, the wavelength and distortion properties, and the holographic optical product operation to generate the hologram are discussed. An off-axis aberration correction method for the generalized holographic zone plate is proposed and experimentally demonstrated. Distortion and wavelength properties for extended form holographic zone plates are discussed. The general form for a holographic zone plate, encompassing all kinds of holographic zone plates, is derived.

A87-32164 Two-dimensional condensing vapor flow on parallel flat plates in an enclosure. YASUNORI KOBAYASHI and TSUYOSHI MATSUMOTO, *Journal of Thermophysics and Heat Transfer* (ISSN 0887-8722), Vol. 1, April 1987, pp. 122-128. 12 Refs. (AIAA Paper 85-1046).

A vapor flow of pure fluid condensing onto a vertical flat plate in an enclosure was examined in order to develop knowledge of the mechanism of vapor condensation and flowfield characteristics. A specific Pyrex glass thermosyphon-like container filled with a certain amount of pure fluid, with or without noncondensable gas, was heated and the upward vapor flow between a pair of cooled parallel plates installed in the upper portion of the container was investigated by means of temperature and pressure sensors as well as laser holographic interferometry. With a pure fluid only (single-component, two-phase flow) in the container, the entire flowfield of condensation region is uniform in density and temperature. On the other hand, with a pure fluid containing a noncondensable gas (two-component, two-phase flow), a distinct flowfield structure is obtained. Its characteristics are: (1) the flowfield in the vapor/gas mixing region has a clear interfacial layer in the longitudinal or axial direction and a rather thick boundary layer near the cooled plate; (2) the condensing vapor flow has an oscillatory character with a low frequency of around 1 Hz, even in the steady-state flow and thermal conditions, and (3) sharp pressure drop was observed at the initiation of nonequilibrium vapor condensation when a large temperature difference existed between the vapor and the cooled plates.

A89-44083 Observation of surface undulation due to single-atomic shear of a dislocation by reflection-electron holography. NOBUYUKI OSAKABE, JUNJI ENDO, TSUYOSHI MATSUDA, AKIRA TONOMURA, and AKIRA FUKUHARA, *Physical Review Letters* (ISSN 0031-9007), Vol. 62, June 19, 1989, pp. 2969-2972. 13 Refs.

A spirally deformed surface due to a single-atomic shear of a screw dislocation emerging on a GaAs(110) surface has, for the first time, been observed with a precision of about 0.10 Å by interferometrically measuring the phase of the reflected electrons. In the case of an obliquely emerging dislocation, the surface around the dislocation core was observed to be deformed asymmetrically rather than uniformly. The result can be explained by considering surface stress relaxation.

A89-38884 Constant radial shearing interferometry with two spiral phase gratings. QING-SHIN RU, NAGAAKI OHYAMA, and TOSHIO HONDA, *Optics Communications* (ISSN 0030-4018), Vol. 70, April 15, 1989, pp. 445-449. Research sponsored by the National Astronomical Observatory of Japan. 8 Refs.

Two spiral phase gratings consisting of triangular grooves have been used to construct a simple constant radial shearing interferometer with small light loss. Quasi-coherent light can be used for illumination, allowing good contrast of fringes to be obtained by selecting a desirable wavelength for the incident wave from a white light source using a set of interference filters. An azimuthal carrier was introduced into the interferogram in order to accurately determine the distribution of the radial derivative of an incident wavefront.

A89-24951 Optical pattern recognition with object-multiplexed reflection-type matched spatial filters. SHUN-ICHI KAMEMARU, MITSUGU KAKUTA, and ISAO SHIMIZU, *Optics Communications* (ISSN 0030-4018), Vol. 69, Jan. 1, 1989, pp. 211-213. 7 Refs.

Simultaneous recognition of the presence and the location of several desired patterns is performed using object-multiplexed reflection-type matched spatial filters (MSFs). The processing system produces the output recognition signals overlapped by the impulse response of the MSF, which makes parallel recognition easier. Experimental results and discussions are given.

A89-23189 Inextensional free vibrations of circular cylindrical shells. TATSUZO KOGA and ARIHUMI SAITO, *AIAA Journal* (ISSN 0001-1452), Vol. 26, Dec. 1988, pp. 1499-1505. 7 Refs.

Asymptotic solutions are obtained for the eigenvalue problems of the inextensional free vibrations of circular cylindrical shells, considering all 45 possible combinations of the boundary conditions, characterizing the simply supported, the clamped, and the free ends. In addition to the well-known Rayleigh and Love types of inextensional vibrations for shells with the free-free ends, a type represented by a linear combination of those classical ones is found in cases where one end is free and the other is supported in such a manner that it can move freely in the axial direction. The existence of the three types of inextensional mode is proved by an experiment and the mode shapes are visualized by holographic interferometry.

A89-38130 Experimental study on high speed gas-particle unsteady flow past blunt bodies. HIROMU SUGIYAMA, KAZUYOSHI TAKAYAMA, HIROMICHI DOI, and HIROSHIGE NAGUMO, *Proceedings of the 18th International Symposium on Space Technology and Science*, Sapporo, Japan, May 22-27, 1988, Vol. 1 (A89-38031 16-12). Tokyo, AGNE Publishing, Inc., 1988, pp. 781-786. 11 Refs.

This paper describes an experimental study on gas-particle high speed unsteady flows past blunt bodies installed in a horizontal dusty-gas shock tube. Air containing fly ashes was used for dusty gas, and two-dimensional circular cylinders for blunt body models. Flow visualization studies were conducted by a schlieren method, high speed camera, and a pulsed laser holographic interferometer. The behavior of shock waves past a circular cylinder in a dusty-gas, the development of dust-free regions and the formation of vortices behind a circular cylinder were observed.

A90-10732 Holographic interferometric study of shock wave propagation. K. TAKAYAMA, K. ITOH, O. ONODERA, and H. OJIMA, *Proceedings of the 18th International Congress on High Speed Photography and Photonics*, Xian, People's Republic of China, Aug. 28-Sept. 2, 1988, Part 1 (A90-10726 01-35). Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, pp. 389-396. 11 Refs.

A successful application study of shock tube flow holographic interferometry has been conducted at the Institute of High Speed Mechanics of Tohoku University, Japan. A shock wave propagation experiment over a circular cylinder, an elliptical cylinder, and an NACA 0012 airfoil was performed, using a 60 mm x 150 mm shock tube of the Shock Wave Research Center equipped with double exposure holographic interferometry with a 300-mm field of view. An NACA 0012 airfoil with an angle of attack was placed in the transonic shock tube flow for quantitative observation of the whole shock propagation process and starting of a transonic flow. The shock Mach number was 1.7 in air and the local flow Mach number was 0.77. The isopycnics were compared with numerical simulation results and the quantitative data were evaluated from the interferograms; the unsteady drag coefficients of these bodies under shock wave loading could be determined both experimentally and numerically. Good agreement was obtained between the experiment and the numerical simulation.

A89-12880 Holographic interferometric study of shock wave propagation in two-phase media. KAZUYOSHI TAKAYAMA, *Shock tubes and waves; Proceedings of the Sixteenth International Symposium*, Aachen, Federal Republic of Germany, July 26-31, 1987 (A89-12876 03-34). Weinheim, Federal Republic of Germany, VCH Verlagsgesellschaft mbH, 1988, pp. 51-62. 21 Refs.

The phenomenon of shock wave propagation in two-phase media was studied using double-exposure holographic interferometry. Three examples are considered: (1) underwater shock wave interaction with air bubbles, (2) dusty gas shock wave flow over a circular cylinder, and (3) shock wave transition over gas-liquid interface. The experimental details are described together with the procedure for deriving the shock-wave pressure profiles from the interferograms and the results obtained.

A89-14960 Synthetic aperture ultrasonic imagery. KEINOSUKE NAGAI, *Advances in electronics and electron physics* (A89-14957 03-33). San Diego, CA, Academic Press, Inc., Vol. 70, 1988, pp. 215-314. 82 Refs.

The basic operating principles, technological implementation, and applications of synthetic-aperture (SA) ultrasonic imaging are reviewed. Topics examined include ultrasonic imaging systems and the resolution problem, holography and SA methods, side-looking SA sonars, digital ultrasonic imaging techniques, properties of transducer arrays, a practical digital imaging system, ultrasonic computer tomography with time-of-flight profiles; diffraction tomography as an inverse problem, and the use of plane-wave, fan-beam, and broadband-pulse waves in diffraction tomography. Diagrams, drawings, and extensive sample images are provided.

A89-24695 Automatic analysis of holographic and shearographic fringes to measure flexural strains in plates. SATORU TOYOOKA, HAJIME NISHIDA, and JURO TAKEZAKI, *Optical Engineering* (ISSN 0091-3286), Vol. 28, Jan. 1989, pp. 55-60. 11 Refs.

The technique of phase measuring by spatially modulated carrier fringes is applied to analyzing holographic and shearographic fringes. The algorithm employed is a simplified version of the Fourier transform method and does not require any special device such as the frequency modulator used in time domain phase detection techniques. Analyzed phase data are numerically differentiated to calculate full-field distributions of flexural curvature and twist, which correspond to flexural strains.

A89-17127 Bending and vibration of CFRP-faced rectangular sandwich plates. HENRIQUE HIROSHI KANEMATSU, YOICHI HIRANO, and HISASHI IYAMA, *Composite Structures* (ISSN 0263-8223), Vol. 10, No. 2, 1988, pp. 145-163. 9 Refs.

A linear analysis for bending and vibration of sandwich plates consisting of an orthotropic core and unbalanced laminated face plates is presented. A solution method is proposed through the principle of minimum total potential energy, and a double Fourier series approach is used for the displacement functions. Analytical and experimental investigations are performed for fully clamped boundary conditions, and the results show reasonable correlation. Holographic techniques were used to obtain the deflection and vibration modes.