BELYKH, B.P., dotsent; AKHLYUSTIN, V.K., dotsent; AVRINSKIY, R.B., inzh.

Conditions of safe servicing of electric equipment with a 6000 v. potential in pits of the Korkinugol' Trust. Izv.vys.ucheb.zav.; gor.zhur. 5 no.2:131-134 '62. (MIRA 15:4)

1. Magnotogorskiy gornometallurgicheskiy institut imeni G.I.Nosova. Rekomendovana kafedroy avtomatizatsii proiavodstvennykh protsessov.
(Chelyabinsk Basin--Excavating machinery--Electric driving)

BOROKHOVICH, Aleksandr Isaakovich, kand.tekhn.nauk, dotsent; AKHLYUSTIN, Veniamin Konstantinovich, kand.tekhn.nauk, dotsent

Electric power supply of deep mines. Izv.vys.ucheb.zav.; elektromekhanika 8 no.6:708-714 '65. (MIRA 18:8)

1. Zaveduyushchiy kafedroy gornoy mekhaniki Magnitogorskogo gornometallurgicheskogo instituta (for Borokhovich). 2. Kafedra gornoy elektrotekhniki Magnitogorskogo gornometallurgicheskogo instituta (for Akhlyustin).

ACCESSION NR: AP4041434 S/0188/64/000/003/0015/0027

AUTHOR: Akhmad, Kh. Kh.

TITLE: Perturbations of hyperbolic elements

SOURCE: Moscow. Universitet. Vestnik. Seriya 3. Fizika, astronomiya, no. 3, 1964, 15-27

TOPIC TAGS: celestial mechanics, osculating hyperbolic element, restricted three-body problem, hyperbolic element perturbation

ABSTRACT: An analytical theory has been developed for the perturbations of hyperbolic elements. In this connection, the author has derived the necessary Lagrangian differential equations for osculating hyperbolic elements. The analytical integration of these equations, containing partial derivatives of the perturbing function for the elements, involves expansion of this function. This expansion is obtained most easily for the circular restricted spatial three-body problem. The expansion of the perturbing function can be obtained for two variants: inner, when $r<a_j$ and outer, when $r>a_j$, where r is the distance from the perturbed body to the central body and a_j is the distance of the perturbing body from the central body. The expansion for the outer variant already has been obtained by Yelenevskaya

Card 1/2

ACCESSION NR: AP4041434

(Byul. ITA, VI, No. 7 (80), 1957), but in inconvenient form. The author gives the expansion of the perturbing function for the case of hyperbolic motion for powers of the ratios of the semi-axes, also applicable for any values of reciprocal inclination. The method used was proposed by R. A. Lyakh (Byull. ITA, VII, No. 6 (89), 1959) and applied by him in the expansion of the perturbing function for a case of elliptical motion. The derivation of the differential equations for osculating hyperbolic elements and the expansion of the perturbation function into a series (both inner and outer variants) is given in detail. Orig. art. has: 1 figure and 62 formulas.

ASSOCIATION: Kafedra nebesnoy mekhaniki i gravimetrii, Moskovskiy universitet (Department of Celestial Mechanics and Gravimetry, Moscow State University)

SUBMITTED: 16Jul63 ENCL: 00

SUB CODE: AA NO REF SOV: 007 OTHER: 002

Card 2/2

AKHMAD, Kh.Kh.

Analytic methods for the determination of disturbances of hyperbolic elements. Vest. Mosk. un. Ser. 3: Fiz., astron. 19 no.4:15-27 S-O '64. (MIRA 17:12)

1. Kafedra nebesnoy mekhaniki i gravimetrii Moskovskogo universiteta.

AUTHOR: Akhmad, Kh. Kh.

ABSTRACT: This is an extension of prev[illegible] author, who has derived differential equations for osculating [illegible] elements of [illegible]

[illegible] perturbing body [illegible] orbital elements [illegible] his expansion for the two cases obtained

Card 2/2

AKHMAD, Kh.Kh.

Disturbances of hyperbolic elements. Vest. Mosk. un. Ser. 3: Fiz., astron. 19 no.3:15-27 My-Je '64.

(MIRA 17:11)

1. Kafedra nebesnoy mekhaniki i gravimetrii Moskovskogo universiteta.

ISHMUKHAMEDOV, Kh.Z. [deceased]; AKHMADALIYEV, M.

Inversion of matrices by A. P. Ershov's method. Vop. vych. mat. i tekh. no.1:28-40 '64. (MIRA 18:8)

SAIDKHODZHAYEV, A.S.; AKHMADALIYEV, M.

Design of complex frame systems with the aid of an electronic computer. Vop. vych. mat. i tekh. no.2:127-165 '64.
(MIRA 18:12)

AKHMADEYEVA, B.N.

Using diagrams of gamma ray measurement for the correlation of the geological cross section in the holes of coreless drilling in a region of the central part of Turkmenia. Vop.rud.geofiz. no.4:7-9 '64. (MIRA 18:1)

AKHMADEYEV, [redacted]

Increase the production of pulse crops in Bashkiria. Zemledelie 5 no.4:81-82 Ap '57. (MLRA 10:6)

1. Bashkirskiy nauchno-issledovatel'skiy institut sel'skogo khozyaystva.

(Bashkiria--Legumes)

NOSOVITSKIY, B.M.; PAPIN, T.I.; TSYS', V.D.; AKHMADEYEV, Kh.A.

Blowing-in the blast furrace for the production of ferromanganese.
Metallurg 6 no.7:8-10 Jl '61. (MIRA 14:6)

1. Donetskiy politekhnicheskiy institut i Konstantinovskiy metallurgicheskiy zavod.
(Blast furnaces) (Ferromanganese)

NOSOVITSKIY, B.M.; PAPIN, T.K.; AKHMADEYEV, Kh.A.

Improving the blast furnace process by the use of graded ore.
Biul.TSIICHM no.9:39-41 '60. (MIRA 15:4)

1. Donetskiy industrial'nyy institut (for Nosovitskiy). 2. Konstantinovskiy metallurgicheskiy zavod (for Papin, Akhmadeyev).
(Blast furnaces)

S/032/63/029/004/002/016
A004/A127

AUTHORS: Kostromin, A.I., Akhmadeyev, M.Kh.

TITLE: Coulomb-meter determination of small Al-quantities

PERIODICAL: Zavodskaya laboratoriya, no. 4, 1963, 402 - 404

TEXT: Electrically generated bromine is used for the bromination reaction of a number of organic compounds and for the titration of some reducing agents. In their investigations, the authors used the bromination reaction of 8-hydroxyquinoline for determining aluminum. The work was carried out on an installation of which a description is given. This method is based on the formation of aluminum hydroxyquinolate and the subsequent reaction of the oxide with the bromine to be generated. There are 3 figures and 1 table.

ASSOCIATION: Kazanskiy gosudarstvenny universitet im. V.I. Ul'yanova-Lenina (Kazan' State University im. V.I. Ul'yanov-Lenin)

Card 1/1

AKHMADEYEVA, R.T.

AKHMADEYEVA, R.T.

[Raising rabbits] Razvedenie krolikov. Moskva, Gos. izd-vo selkhoz. lit-ry, 1957. 211 p. (MIRA 11:3)
(Rabbits)

AKHMADEYEVA, R.T.

[Rabbit breeding] Razvedenie krolikov. 2. izd., ispr. i dop. Moskva, Gos. izd-vo sel'khoz.lit-ry, 1959. 205 p.

(MIRA 15:5)

(Rabbits)

APPROVED FOR RELEASE: 06/05/2000 CIA-RDP86-00513R000100610009-4"

NIKOLAYEV, A.I., kand.med.nauk; AKHMADIYEVA, A.Kh.

Relation of the synthesis of antibodies to the state of nucleic acids. Report No.1. Med. zhur. Uzb. no.2:75-77 F '62. (MIRA 15:4)

1. Iz Nauchno-issledovatel'skogo instituta rentgenologii, radiologii i onkologii Ministerstva zdravookhraneniya UzSSR (direktor - prof. D.M.Abdurasulov).

(NUCLEIC ACIDS) (ANTIGENS AND ANTIBODIES)
(CARBON--ISOTOPES)

NIKOLAYEV, A.I., kand.med.nauk; SEID-MANSURI BEYUK MIR-ABDULLA;
AKHMADIYEVA, A.Kh.

Investigation of the permeability of vessels, the sorptive capacity of tissues, and the excretory function of the body in irradiated mice by means of labeled sodium sulfate (S^{35}).
Med. zhur. Uzb. no. 2:50-53 F '61. (MIRA 14:2)

1. Iz Nauchno-issledovatel'skogo instituta rentgenologii, radiologii i onkologii Ministerstva zdravookhraneniya UzSSR (direktor - prof. D.M. Abdurasulov).
(BLOOD VESSELS—PERMEABILITY) (TISSUES)
(RADIATION—PHYSIOLOGICAL EFFECT) (SODIUM SULFATE)

NIKOLAYEV, A.I.; AKHMADIYEVA, A.Kh.; MAKAROV, G.F.

Formation of antibodies to sarcolysine and their effect on the antineoplastic activity of the preparation. Biul. eksp. biol. i med. 60 no.7:95-98 Jl '65. (MIRA 18:8)

1. Uzbekskiy nauchno-issledovatel'skiy institut rentgenologii, radiologii i onkologii (direktor - prof. D.M. Abdurasulov), Tashkent.

AKHMADULLINA, G.G., TROITSKIY, V.L.

Subcutaneous Vaccination Against Flexner Dysentery," 1943.

Centrl. Inst. Epidemiol. & Microbiol/and/ or Kazan Inst. Epidemiol. and Microbiol. Moscow.

AKHMADULLINA, G.G.

G.G.

ADO, A.D., professor, zaviduvach; ISHYMOVA, L.M.; AKHMADULLINA, ~~H.H.~~

Reflex regulation of the phagocytic activity of leucocytes. Medych.zhur. 21 no.4:53-57 '51. (MLRA 6:10)

1. Kafedra patolohichnoyi fiziolohiyi Kazans'koho derzhavnoho medychnoho instytutu. (Phagocytosis) (Leucocytes)

AKHMADULLINA, G.G.

SPIRINA, A.A.; KAZAKEVICH, N.B.; KMIT, M.I.; SVETOVIDOVA, V.M.; KHAIT, V.S.; ARONOV, M.S.; BORISKINA, K.I.; PERSHIN, G.N.; BELOZEROVA, K.A.; KARPOV, S.P.; KOVAL'SKIY, G.N.; RYBKINA, L.G.; BALYBERDINA, L.D.; AKHMADULLINA, G.G.; DEMIKHOVSKIY, Ye.I.

Annotations of articles which reached the editorial office. Zhur.mikrobiol. epid,i immun. no.2:88-89 F '53. (MLRA 6:5)

1. Kurskiy institut epidemiologii i mikrobiologii(for Spirina, Kazakevich and Kmit). 2. Tambovskiy institut epidemiologii i mikrobiologii (for Svetovidova). 3. Kafedra mikrobiologii Odesskogo meditsinskogo instituta (for Khait). 4. Kafedra mikrobiologii i operativnoy khirurgii Kuybyshevskogo meditsinskogo instituta (for Aronov, and Boriskina). 5. Vsesoyuznyy nauchno-issledovatel'skiy khimiko-farmatsevticheskiy institut (for Pershin and Belozerova). 6. Kafedra mikrobiologii Tomskogo meditsinskogo instituta imeni V.M. Molotova (for Karpov). 7. Tomskiy institut epidemiologii i mikrobiologii (for Karpov). 8. Krasnodarskiy institut epidemiologii i mikrobiologii imeni Savchenko (for Koval'skiy and Rybkin). 9. Kafedra infektsionnykh bolezney Sverdlovskogo meditsinskogo instituta (for Balyberdina). 10. Kazanskiy institut epidemiologii i mikrobiologii (for Akhmadullina). 11. Kafedra mikrobiologii Dnepropetrovskogo meditsinskogo instituta (for Demikhovskiy). (Bacteria, Pathogenic) (Antibiotics) (Phagodytosis)

AKSYUK, A.F., kand.med.nauk; VERSHININ, A.A., inzh; LYUTOV, A.V., inzh.; AKHMADULINA, M.S., inzhener-khimik.

Experience in the fluoridation of the water supply in the U.S.S.R. Gig. i san. 28 no.1:68-73'63. (MIRA 16:7)

1. Iz Moskovskogo nauchno-issledovatel'skogo instituta gigiyeny imeni F.F. Erismana i tsekha "Vodokanal" Noril'ska.
(WATER—FLUORIDATION)

AKHMADYEVA, A., NIKOLAYEV, A. I. (USSR)

"The Mechanism of Antibody Synthesis."

Report presented at the 5th International Biochemistry Congress, Moscow, 10-16 August 1961

AKHMAKOV, V.S.

Some notes on a popular manual "Equipment for signaling, central control and block systems" A.M. Bryleev. Reviewed by V.S. Akhmakov. Avtom., telem. i sviaz' no.3:47 Mr '57. (MLRA 10:4)

1. Nachal'nik laboratorii Moskovskogo metropolitena imeni V.I. Lenina.
(Railroads--Signaling--Block system) (Bryleev, A.M.)

AKHMAKOV, V.S.

SEMERNIK, M.L.; AKHMAKOV, V.S.

Rail circuits with capacitance limiter. Avtom., telem.i sviaz' no.10:23-25 O '57. (MIRA 10:11)

1. Nachal'nik otdela Signalizatsii, tsentralizatsii, blokirovki Moskovskogo metropolitena (for Semernik). 2. Nachal'nik laboratorii signalizatsii i svyazi Moskovskogo metropolitena (for Akhmakov).
(Railroads--Communication systems)

AKHMAKOV, V.S.

Useful aid for technical schools. Avtom., telem.i sviaz 2 no.4:42 Ap '58. (MIRA 12:12)

1. Nachal'nik laboratorii Moskovskogo metropolitena im. V.I. Lenina.
(Railroads--Signaling)

AKHMAMET'YEV, M.A. (Novosibirsk); TOMSONS, Ya.Ya. (Novosibirsk)

Dynamics of automatic optimalizing bridges. Avtometriia no.4:63-74 '65. (MIRA 18:9)

TULUYEVSKIY, Yu.N.; SLOBODKIN, Ye.M.; AKHMANAYEV, S.I.; KIREYEV, N.K.

Measurement and the dynamic characteristics of the temperature of open-hearth furnace roofs. Izv. vys. ucheb. zav.; chern. met. 7 no.9:179-185 '64. (MIRA 17:6)

1. Chelyabinskiy nauchno-issledovatel'skiy institut metallurgii.

USMANOV, Kh.U.; AKHMAMEDOV, K.; MININA, V.S.

Variation in the carbohydrate composition of hydrolyzates of the husk of naturally stripped seeds in stepped hydrolysis. Izv. AN Turk. SSR. Ser. fiz.-tekh., khim. i geol. nauk no.4:38-42 '63. (MIRA 17:2)

1. Institut khimii polimerov AN Uzbekskoy SSR i Institut khimii AN Turkmenskoy SSR.

ACC NR: AP7008270 SOURCE CODE: UR/0141/67/010/001/0146/0149

AUTHOR: Akhmanov, S. A.; Baklanova, V. V.; Chirkin, A. S.

ORG: Moscow State University (Moskovskiy gosudarstvennyy universitet)

TITLE: Parametric amplification with multi-mode pumping

SOURCE: IVUZ. Radiofizika, v. 10, no. 1, 1967, 146-149

TOPIC TAGS: parametric amplifier, laser effect, nonlinear optics, OPTIC PUMPING

ABSTRACT: A theoretical study was made of the effect of multi-made pumping on the parametric amplification of traveling em waves. It was shown that those effects which do not fit into the theory of parametric amplification due to non-monochromatic pumping (e.g., lack of agreement between the experimented and calculated values of the parametric amplification and generation thresholds, decreased phase selectivity of "degenerate" parametric light amplifier, anomalous spectral broadening of amplified signal) may be explained if it is assumed that the pumping source used in practice is nonmonochromatic. The results indicate that in parametric processes this mode structure of the pumping source may considerably effect quantitative values. When used in the study of the processes of stimulated scattering of modulated emission, the proposed

ACC NR: AP7008270

method yields sufficiently general quantitative results. Orig. art. has: 2 figures and 13 formulas.

[WA-14]
[JM]

SUB CODE: 20/ SUBM DATE: 6Apr66/ ORIG REF: 006/ OTH REF: 006

Card 2/2

AKHMANOV, S. A.

"Slow Frequency and Amplitude Fluctuations in a Reflex Klystron."

Dealth with a method and the results of an experimental investigation of spectral densities of frequency and amplitude fluctuations in a 3-cm wave reflex klystron within the range of 100 cps to 5 kc. The author showed that the spectral density of the klystron frequency fluctuations changed within the indicated range as 1/f, when all electrodes were fed from batteries, and that the phase dispersion during the time of 10^{-3}-10^{-4} seconds was principally determined by slow fluctuations.

report presented at the 1st All-Union Conference on Statistical Radio P hysics, Gor'kiy,=13-18 October 1958. (Izv. vyssh uchev zaved-Radiotekh., vol. 2, No. 1, pp 121-127) COMPLETE card under SIFOROV, V. I.)

AKHMANOV, S. A., ANTONOV, G. F. (MGU, Moscow)

"The Fluctuations in a Super-high Frequency Radio Pulse Oscillator With a Reflex Klystron."

They investigated the fluctuation effects, appearing as settling time fluctuations of the stationary amplitude and phase and as phase and amplitude fluctuations during a radio pulse. The author presented the results of theoretical and experimental investigations.

report presented at the 1st All-Union Conference on Statistical Radio Physics, Gor'kiy, 13-18 October 1958. (Izv. vyssh uchev zaved-Radiotekh., vol. 2, No. 1, pp 121-127) COMPLETE card under SIFOROV, V. I.)

AKHMANOV, S. A., GVOZDOVER, S. D., KONSTANTINOV, YU. S., TROFIMENKO, I. T. (MGU, Moscow)

"An Autodyne Radiospectroscope in the 3-cm Wave Range".

report presented at the All-Union Conference on Statistical Radio Physics, Gor'kiy, 13-18 October 1958. (Izv. vyssh uchev zaved-Radiotekh., vol. 2, No. 1, pp 121-127) COMPLETE card under SIFOROV, V. I.)

AKHMANOV, S. A.

AUTHOR: Artamonov, A.A., Dotsent 3-58-2-21/33

TITLE: Intervuz's Scientific and Methodical Conferences (Mezhduvuzovskiye nauchnyye i metodicheskiye konferentsii) The Second Conference on Radio-electronics (Vtoraya konferentsiya po radioelektronike)

PERIODICAL: Vestnik Vysshey Shkoly, 1958, # 2, pp 74 - 76 (USSR)

ABSTRACT: This second conference began in September 1957 in Saratov. Over 140 reports were submitted to the 400 participants at the general meetings and in the numerous sections (on electronics, electrodynamics, radioastronomy and radiospectroscopy, diffusion of radio waves, semiconductors and their application in radio sets).

N.D. Devyatkov, Member-Correspondent of the USSR Academy of Sciences showed the intensive development of UHF electronic devices intended to work in a broad frequency band.

Reports were also delivered on the fluctuating phenomena in electronic and gas-discharging devices including the physics of these phenomena, and gas discharges of ultrahigh frequencies. S.A. Akhmanov, G.F. Antonov, N.P. Tikhomirova, and I.T. Trofimenko (MGU), who spoke on fluctuating phenomena in auto-oscillating (UHF) systems. Yu.V. Gorokhov, and I.T. Byzovoy (MGU), dealt with effects of gas discharge on hollow

Card 1/4

3-58-2-21/33

Intervuz's Scientific and Methodical Conferences. The Second Conference on Radio-electronics

resonators. A.M. Aleskovskiy (Saratov University) spoke on the distribution of electrons by speed in a decomposing plasma. V.N. Nikonov (Gor'kiy University) told of the fluctuations of frequency and amplitude of oscillations in a klystron generator.

The reports delivered in the Section on Electrodynamics were generally concentrated on theoretical and experimental research of the propagation of electromagnetic waves in impeding systems of different kinds. The following were given: "Dispersion Properties of Some Pin Impeding Systems (V.M. Dashenkov - Saratov University), "Interference Method of Cold Researches on Impeding Systems" (A.I. Shtyrov - Saratov University), "On the Measurement of the Impedance of Contact in Quasi-Cylindrical Impeding Systems" (A.V. Gaponov - Gor'kiy University), "On Diffraction Problems Having Substantial Significance for the Analysis of Directed Antenna Diagrams" (Ye.N. Vasil'yev and S.M. Verevkin - Moscow Power Engineering Institute).

In the Section on Radioastronomy and Radio-spectroscopy, the report of V.V. Zheleznyakov (Gor'kiy University) "On the Theory of a Sporadic Radio Radiation of Jupiter" aroused much

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interest.

G.G. Getmantsev (Gor'kiy University) concentrated his report on the origin of cosmic non-thermal radio radiation. The scientific collaborators of the MGU, A.M. Prokhorov, V.N. Zverev and L.S. Korniyenko, reported on their research work on the fine and superfine spectrum structure of the electronic para-magnetic resonance of chrome and iron ions in the lattice of aluminum oxide.

In the Section on Radio Wave Propagation the most significant lectures where those on the propagation of ultra-short waves in the troposphere, and on the influence of solar activity on the ionosphere. These reports were read by A.A. Semenov, Ch.Ts. Tsydypov (Moscow University); N.N. Yeryushev, N.A. Savich-Krymskaya (Astrophysical Observatory of the USSR Academy of Sciences) and N.G. Denisov (Gor'kiy University)

The Section on Semiconductors and Their Use in Radiosets concentrated its attention on the questions of devising engineering methods in designing various radio circuits with semiconducting devices as well as circuits for transient pro-

3-58-2-21/33

Intervuz's Scientific and Methodical Conferences. The Second Conference on Radio-electronics

cesses. A part of the lectures delivered to this section dealt with the technology of manufacturing useful semiconducting materials (L.S. Berman from the Institute of Semiconductors of the USSR Academy of Sciences; Z.I. Kar'yaschkina - Saratov University; V.V. Pasynkov and Ya.I. Panova - Leningrad Electro-Engineering Institute)

The conference pointed out that notwithstanding the successes achieved in research, the work of vuzes in the field of radio-electronics has fallen behind. The scientists must develop a number of important problems of modern electronics: the scientific foundations for making new electrovacuum devices, questions of experimental radioastronomy, the tropospheric propagation of ultra-short waves, etc. The conference further recommended that a number of "problem laboratories" be organized in those vuzes where scientific-research work in this direction is being successfully carried on.

It is intended to convene the 3rd conference in Khar'kov in September 1959.

ASSOCIATION: Ministerstvo vysshego obrazovaniya SSSR (USSR Ministry of Higher Education)

AVAILABLE: Library of Congress

Card 4/4

SOV-120-58-3-32/33

AUTHORS: Akhmanov, S. A., Gvozdover, S. D., Konstantinov, Yu. S., and Trofimenko, I. T.

TITLE: Application of a TWT-Generator and the Observation of Electron Paramagnetic Resonance (Ispol'zovaniye LBV-generatora dlya nablyudeniya elektronnogo paramagnitnogo rezonansa)

PERIODICAL: Pribory i Tekhnika Eksperimenta, 1958, Nr 3, p 109 (USSR)

ABSTRACT: A travelling wave tube (TWT) connected across an external feedback circuit may be used as a generator of u.h.f. vibrations (Refs.1 and 2). The frequency of the vibrations is determined by a resonator in the feedback circuit. Such a generator has been used by the authors in the 3 cm region in the observation of electron paramagnetic resonance. The specimen under investigation (diphenylpicrylhydrazyl) was placed directly in the generator circuit and in the electromagnet gap. The uniformity of the external magnetic field was sufficiently high and had no effect on the form of absorption lines. The absorption signal was detected by a crystal detector placed in the feedback channel. As the feedback is reduced and the oscillation threshold is approached the sensitivity of the TWT

Card 1/2

generator increases. In the observation of an absorption signal recorded on the screen of an oscilloscope, the signal-to-noise ratio for a specimen containing 2×10^{-8} moles of diphenylpicrylhydrazyl was not less than 4:1 (bandwidth of the low frequency oscillator was 2 kc/s). There are no figures or tables. Of the two references, 1 is Soviet and 1 is English.

ASSOCIATION: Fizicheskiy fakul'tet MGU (Department of Physics of the Moscow State University)

SUBMITTED: March 11, 1958.

1. Vibration--Propagation 2. Traveling wave tubes--Applications 3. Resonance--Magnetic factors

AUTHORS: Akhmanov, S.A. and Ennok, K.A. 109-3-2-18/26

TITLE: Amplitude Fluctuations in the System of Two Mutually-synchronised Reflex Klystrons (Fluktuatsii amplitudy v sisteme dvukh vzaimno-sinkhronizovannykh otrazhatel'nykh klistronov)

PERIODICAL: Radiotekhnika i Elektronika, 1958, Vol.III, No.2, pp. 279 - 283 (USSR).

ABSTRACT: The problem was investigated experimentally by means of the measuring equipment shown in Fig.1. This consisted of two klystrons K_1 and K_2 which were coupled by means of a T-junction. The coupling could be controlled by means of attenuators, A_1 and A_2. The output signal of the system was injected into a waveguide system which comprised an attenuator, A_3, a measuring line section and an accurate wavemeter, B. This was followed by a waveguide hybrid, whose one branch contained a resonator having a Q-factor of 1 000. A switch, ΠP_3, was used to direct the investigated signal either to a power-meter or a detector head. Matching of the waveguide system was carefully controlled over a frequency range of 100 Mc/s. The experimental results are shown in

Card1/2

Figs. 2 and 3. The thin-line curves of Fig.2 represent the power output of the two Klystrons as a function of frequency; while the thick-line curves represent the distribution of the output power fluctuations or noise; Curve 4 and Curve 5 relate to the noise of the individual klystrons, while Curve 6 represents the noise of the two synchronised klystrons. Similar curves for a different klystron system are shown in Fig.3. Further curves are given in Fig.6; these were taken for a finite phase difference between the oscillations of the two klystrons. The authors thank Professor S.D. Gvozdover for proposing the subject and his help; gratitude is also expressed to K.P. Krylov for his help in the building of the equipment. There are 5 figures and 3 Russian references.

ASSOCIATION: Physics Department of the Moscow State University im. M. V. Lomonosov (Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta im. M. V. Lomonosova)

SUBMITTED: March 8, 1956
AVAILABLE: Library of Congress
Card 2/2 1. Klystrons-Performance-Analysis

SOV/120-59-2-11/50

AUTHORS: Akhmanov, S.A., Gvozdover, S.D., Konstantinov, Yu.S., and Trofimenko, I.T.

TITLE: An Autodyne 3 cm Radiospectroscope for Electron Paramagnetic Resonance Studies (Avtodinnyy radiospektroskop 3-santimetrovogo diapazona dlya nablyudeniya elektronnogo paramagnitnogo rezonansa)

PERIODICAL: Pribory i tekhnika eksperimenta, 1959, Nr 2, pp 38-40 (USSR)

ABSTRACT: A travelling-wave tube is fitted with variable phase-shifters and a ferrite isolator and is used in a regenerative (or super-regenerative) mode. The oscillation frequency is that of the cavity containing the specimen. The system is tested on DPPH; $2x10^{-8}$ mole is readily detected in the autodyne mode. The magnet is normal; a simple crystal-video detection system is used. The quenching frequency (20-30 kc/s) used in the super-regenerative mode is applied to the spiral on the travelling-wave tube. The sensitivity can, in favourable cases, be increased by a factor of 2-3, but

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SOV/120-59-2-11/50

An Autodyne 3 cm Radiospectroscope for Electron Paramagnetic Resonance Studies

superheterodyne or other methods are needed to give any further improvement.

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There are 2 figures and 4 references, of which 2 are Soviet and 2 English.

ASSOCIATION: Fizicheskiy fakul'tet MGU (Physics Department, Moscow State University)

SUBMITTED: January 14, 1958

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S/141/60/003/01/012/020
E192/E582

9,3260

AUTHOR: Akhmanov, S. A.

TITLE: Fluctuating Character of the Amplitude Transient of the Oscillations in an Oscillator

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1960, Vol 3, Nr 1, pp 110-115 (USSR)

ABSTRACT: An autonomous Thompson-type oscillator, which can be described by a semi-cubic non-linearity, is considered. It is assumed that at an instant t = 0, a negative resistance is inserted into the resonant circuit in such a way that no transients occur in the networks. In this case the only sources of the initial voltage in the resonant circuit of the oscillator are the shot and thermal noises. Under these conditions the transient of the oscillations, commencing at t = 0, is in the form of a non-stationary random process and can be fully characterized by non-stationary amplitude and phase distribution functions. In order to determine these distribution functions it is necessary to analyse

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the non-linear equation of the oscillator, which contains a fluctuating external signal in its right-hand side portion and is subject to random initial conditions. It is known (Ref 6) that the amplitude transient in a Thompson-type oscillator with a semi-cubic non-linearity can be described by

$$A(t) = A_y / \sqrt{1 + Ce^{-2\beta t}} \qquad (1)$$

where C is a random quantity which is related to the initial amplitude A_o by

$$A_o = A_y / \sqrt{1 + C}.$$

The initial amplitude A_o has the Rayleigh distribution function:

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$$W(A_o) = \frac{A_o}{\sigma_o^2} e^{-A_o^2/2\sigma_o^2} .$$

The amplitude distribution function is given by

$$W_t(A) = K^2 A_y^2 \frac{A}{\left[A^2 + (A_y^2 - A^2)e^{2\beta t}\right]^2} \exp\left\{2\beta t - \frac{K^2}{2} \frac{A^2}{A^2 + (A_y^2 - A^2)e^{2\beta t}}\right\} \quad (2)$$

where the quantity $K^2 = A_y^2/\sigma_o^2$; here σ_o^2 represents the spread of the noise, while A_y is the amplitude of the oscillations in the steady state. Eq (2) is used to plot the distribution function W_t for the case of $K^2 = 5 \times 10^3$. The resulting curves are shown in Figs 1, for various values of α which is defined as $\alpha = 2\beta t$. The graphs of the transient spread σ_x^2 as

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a function of α for two values K^2 (K^2 = 50 and $K^2 = 5 \times 10^3$) are shown in Fig 2. From these graphs it is seen that at $K^2 = 5 \times 10^3$ the maximum of the transient amplitude spread occurs at α = 10. It follows therefore that at $K^2 = 5 \times 10^3$ it is possible to employ approximate initial conditions for the fluctuations. The above theory was checked experimentally by investigating the statistical characteristics of the amplitude transient of the oscillations (Ref 5). The theory and the experiment are in good agreement. The author expresses his gratitude to S. D. Gvozdover for his interest in this work and to V. B. Glasko for collaboration in the numerical calculations. There are 3 figures and 7 references, 6 of which are

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Soviet and 1 English.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: July 31, 1959

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82451

9.4220

S/141/60/003/03/006/014
E192/E382

AUTHORS: Akhmanov, S.A. and Antonov, F.G.

TITLE: Amplitude Oscillations in a Pulse Generator Based on a Reflex Klystron

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1960, Vol. 3, No. 3, pp 405 - 418

TEXT: An investigation of the unidimensional distribution functions characterising the amplitude transient in klystrons was carried out. The functions of interest were $W_{t_i}(A)$, which describes a distribution of the amplitude at various time instants t_i and $W_{A_i}(t)$, describing the probability of reaching a given value of the amplitude A_i at a time t. These functions were determined experimentally for an "autonomous" reflex klystron and for a klystron which was "excited" by an external signal. The block schematic of the experimental equipment operating at the wavelength of 10 cm is shown in Fig. 1. This consists of: 1) a modulating generator; 2) a standard generator; 3) a delay

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line; 4) a sawtooth-voltage generator; 5) a pulse oscillograph; 6) a discriminator; 7) a sensitive power meter; 8) a wideband amplifier; 9) a three-branch waveguide; 10) the klystron; 11) a wavemetor; 12) an ultrahigh-frequency generator; 13) a spectrum analyzer and 14) a measuring line. The generator of the standard pulses was employed to trigger the time base of the oscillograph and a generator of rectangular pulses having a duration ranging from 0.5 to 10 µs and a rise time of less than 0.1 µs; the latter was used to modulate the reflector of the klystron. The envelopes of the high-frequency pulses generated by the klystron were observed on the screen of the oscillograph. If the klystron was operated a large number of times, it was possible to investigate the desired random process; the envelopes of the klystron pulses were photographed and the distribution functions $W_t(A)$ and $W_A(t)$ were

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Amplitude Oscillations in a Pulse Generator Based on a Reflex Klystron

determined by photometering the film. A typical picture obtained on the oscillograph is shown in Figure 2. Since the axis of the abscissa is the time axis, the function $W_A(t)$ is obtained by photometering of the oscillogram along the time axis. By photometering the film along the axis of the ordinates, it is possible to obtain the function $W_t(A)$. The experimental results are shown in Figs. 3-6. Fig. 3 shows the function $W_A(t)$ for various reflector voltages. The distribution function of the ratio of a given amplitude to its steady-state value $(x = A/A_y)$ is plotted in Fig. 4 against x for various values of $\Delta\tau$, where $\Delta\tau$ denotes the instant of application of the modulating pulse. From the experimentally determined function $W_A(t)$, it is possible to determine the dispersion $\overline{\Delta t^2}$

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of the time necessary for reaching an amplitude A_i and the average time $\bar{t}$ necessary for reaching the above amplitude. Figure 5 shows the square root of the dispersion as a function of P/P_{max}, which represents the ratio of the power at a given point of the generation zone to the power at the centre of the zone. The dispersion of the quantity $x = A/A_y$ as a function of t is illustrated in Fig. 6, where the first curve corresponds to the power ratio of 0.7 and the second curve is for the power ratio of 0.45. The above results can be explained by considering the dynamic operation of a klystron. It is assumed that the amplitude transient is described by:

$$A(t) = \frac{A_y}{\sqrt{1 + Ce^{-2\beta t}}} \qquad (1)$$

where C is a quantity determined by the initial oscillation amplitude in the resonator and β is the increment defined by Eq.(2) (Ref. 12). By analyzing Eq. (1), it is concluded that the shot and thermal noises are the main sources of the amplitude fluctuations observed in the transients. The two probability distribution functions can be expressed by Eqs. (3) and (4), provided it is assumed that the non-linearities in the klystron are of no consequence (Refs. 4,6,8). On the basis of Eqs. (3) and (4), it is found that the square root of the time dispersion is given by Eq (5), while the amplitude dispersion is defined by Eq. (6). By comparing the theoretical and experimnetal results (graphs of Figs. 4 and 6 with the formulae (4) and (6)), it is seen that a satisfactory agreement between the two is observed only during the initial stage of the transient process. The average rise time of the amplitude transient can be reduced by introducing an external sinusoidal source into the resonance system of the generator. This method was investigated experimentally and it was found that if the external signal had a power lower

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than 10^{-9} W, it had no effect on the rise time of the oscillation amplitude; however, at powers of the order of 10^{-8} W, a significant improvement could be observed. This is illustrated in Fig. 7. The authors express their gratitude to S.D. Gvozdova for her constant interest in this work and to G.A. Yelkin and I.T. Trofimenko for discussing the results. The authors also thank I.L. Bershteyn for reading the manuscript and for valuable remarks. There are 7 figures and 14 references: 2 English, 1 German and 11 Soviet.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: October 23, 1959

Card 6/6

21602
S/109/60/005/010/025/031
E073/E482

9,4231

AUTHORS: Akulina, D.K., Akhmanov, S.A., Gvozdover, S.D., Gorshkov, A.S. and Trofimenko, I.T.

TITLE: Parametric Phenomena in Wave Systems With Long Electron Beams

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol.5, No.10, pp.1736-1739

TEXT: The phenomenon of parametric regeneration which was first investigated by L.I.Mandel'shtam and his associates (Ref.1) in systems with lumped constants may also occur in wave systems (Ref.2). The considerable interest in wave systems with modulated parameters is due to the prospects of building stable amplifiers and frequency converters with a very wide band which are simple to tune and are unidirectional. In principle, it is possible to obtain in the wave systems noise characteristics which are the same as those obtained in parametric circuit amplifiers. One of the possible variants of wave systems with modulated parameters are wave systems with long electron streams. First, a freely drifting beam of electrons represents a form of transmission line; modulation of the current density by a strong pump signal is

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analogous to some extent to the modulation of the distributed parameters of a transmission line (Ref.3 and 4). Another example of a waveguide system in which the modulation of the density of the electron beam can lead to parametric effects is a system consisting of a beam of electrons linked with a delay system. Wave systems with long electron beams are at present one of the most suitable fields for studying parametric phenomena in wave systems, since it is difficult to produce purely distributed wave systems with semiconductors and ferrites. In this paper the results are briefly described of experiments on parametric amplification and transformation of the frequency in wave systems with long electron beams in which the interaction of the electrons with the high frequency field in the longitudinal direction is utilized (see also earlier work of the authors, Ref.5 and 6). The experiments were made in the centimetre ($f_c \simeq 3000 - 3500$ Mc/s, frequency of $f_H \simeq 6000$ Mc/s) and the decimetre ($f_c \simeq 1000 - 1800$ Mc/s, $f_H \simeq 3000 - 3500$ Mc/s) ranges. In the experimental set-up both the pump source and the signal were introduced into the electron beam by means of sections of helical lines. The main beam of the electrons first passed

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through the first helix in which it was modulated by the pump signal and then into the second part of the tube where it interacted with the signal. The interaction was realized either in a drift tube (for feeding in and for extracting the signal, small sections of helical lines were used) or in the helical line. The power of the pump signal at the input and the output of the first helix was monitored; measures were provided for filtering the pump signal on the indicating apparatus. The block schematic is given. The parametric amplification was clearly observed in systems of both types for powers of the pump source varying between 200 μW and 1W. A common feature was the very wide band of the parametric amplification. Thus, in the decimetre range, the amplification was in a band of about 500 to 600 Mc/s with very little change in the gain for the band of the pump source of 200 to 300 Mc/s. In conclusion, the following is stated. Parametric amplification in wave systems with electron beams extends over a very wide band; for pump signal powers of 10 to 100 mW in systems with lengths not exceeding the dimensions of ordinary TWT, a real gain of about 20 db and more can be achieved. Comparison of the experimental data with results of
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calculations by W.Loisell and C.Quate (Ref.3 and 8) shows that the theory does not adequately explain the observed phenomenon. Firstly, disregarding of the combination frequencies is not justified and, secondly, various phenomena, as for instance the non-monotonic relationship between the coefficient of parametric amplification and the power of the pump source etc, are not explained by the work of Loisell. On the other hand, a number of experimental facts are in qualitative agreement with the theory; for instance, the selective properties of the investigated systems, the dependence of the coefficient of parametric amplification on the voltage of the beam for systems with a beam and a delay line. In the investigations described, no special measures were taken for picking up the noise energy; the minimum noise coefficient of the systems investigated was at the level of the noise of the appropriate travelling wave tubes. Even in their present state electron wave parametric systems may be of interest from the point of view of wide band mixing and division of frequencies.
Acknowledgments are expressed to A.S.Tager for his comments on the results and to V.G.Dmitriyev and A.A.Ovsyannikov for their

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assistance with the measurements. There are 2 figures and 8 references: 4 Soviet and 4 non-Soviet.

ASSOCIATION: Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta im. M.V.Lomonosova Kafedra radiotekhniki (Physics Department, Moscow State University imeni M.V.Lomonosov, Radioengineering Chair)

SUBMITTED: October 30, 1959 (initially)
May 5, 1960 (after revision)

9,2572 25959 S/141/61/004/001/019/022
E192/E382

AUTHORS: Akhmanov, S.A., Romanyuk, A.K. and Strukov, M.M.

TITLE: The Characteristics of a Double-tuned Parametric Oscillator

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1961, Vol. 4, No. 1, pp. 179 - 181

TEXT: The purpose of this paper is to give some experimental results relating to the investigation of double-tuned parametric oscillators. The data on such oscillators seems to be scarce, except for the work of V.A. Lazarev (Ref. 2 - ZhTF, 10, 918, 1940), where the parametric excitation of a system consisting of two coupled tuned circuits was investigated theoretically and experimentally. The system considered in this work is in the form of two tuned circuits coupled by means of a periodically-changing reactance (similar to that of Ref 3 (H. Heffner, G. Wade - J. Appl. Physics, 29, 1321, 1958)). The principal parameter of interest in this system is its frequency stability, since it produces two frequencies f_1 and f_2, such that $f_1 + f_2 = f_H$, where f_H is the
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pump frequency. The frequencies f_1 and f_2 can be continuously varied by varying the resonant frequencies f_{01} and f_{02} of the tuned circuit in such a way that $f_{01} + f_{02} \simeq f_H$. In other words, a double-tuned oscillator of this type is variable while its pump frequency is fixed. The studied amplifiers cover the frequency range from 2 - 20 Mc/s as well as UHF (pump frequencies of 6 000 and 9 000 Mc/s). The variable reactances amployed were in the form of germanium p-n junction diodes. At UHf the tuned circuits had Q-factors of the order of 50 - 80 and the oscillators were excited at pump powers of 10 - 20 mW; on the other hand, the oscillators for the lower frequencies were excited at pump signals of 1.5 - 2 V. The power generated by the oscillators was 10-14 db lower than the pump power. The steady-state amplitude of the oscillator output was largely dependent on the nonlinear conductance of the diodes. The frequency-stability measurements were carried out by using a crystal-stabilized pump-source generator operating at $f_H = 28$ Mc/s. The block schematic of the measuring system is given in Fig. 1. In the first series of experiments, the frequencies f_1 and f_2 were varied between 11 and 13 Mc/s and 17 and 15 Mc/s, respectively; in the second group of experiments, $f_1 \simeq 5$ Mc/s and $f_2 \simeq 23$ Mc/s. The experimental results showing the dependence of the generated frequency on the changes of the reactances in the tuned circuits are shown in Fig. 2. The axis of the abscissae shows the relative change $\Delta C_1/C_1$ of the tuning capacitance C_1 of the first circuit, while the axis of the ordinates gives the corresponding relative change $\Delta C_2/C_2$ of the capacitance C_2 of the second circuit, which is necessary to ensure the stability of the frequency f_1. It is seen that the signs of ΔC_1 and ΔC_2 coincide and that for $Q_1 = Q_2$, the ratio $\Delta C_1/C_1 = \Delta C_2/C_2$ (see Curve 1). In general, these two ratios differ by a factor K , which is dependent on the damping of the circuits; for the graphs II and IV, $Q_1 > Q_2$, while for the graph III $Q_1 < Q_2$. It is concluded, therefore, that the "unilateral" deviations of the reactive parameters in a double-tuned parametric oscillator are mutually compensated. The frequency stability of the system is dependent, to some extent, on the pump voltage and this effect amounted to 50 - 70 cps/V. The influence of the fluctuations of the variable reactance diode on the frequency stability can be made negligible since the temperature coefficient of the p-n junction is low and the biasing source for the diode can be made very stable. The authors express their gratitude to Yu.Ye. D'yakov for suggesting the formulae and for valuable remarks, to S.D. Gvozdover for his interest in this work and to A.V. Krasilov for supplying the semiconductor diodes.

APPROVED FOR RELEASE: 06/05/2000 CIA-RDP86-00513R000100610009-4"

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The Characteristics of ....

There are 2 figures and 6 references: 2 Soviet and 4 non-Soviet. The four English-language references quoted are: Ref. 3 (quoted in text); Ref. 4 - A. Uhlir, Proc. IRE, 46, 1115, 1958; Ref. 5 - Hsu-Hsiung - NSIA-ARDC Conf. Electron., Washington, 1958, p. 81; Ref. 6 - P. Fitzgerald, G. Wade and C. Crumly, IRE Trans. Electron. Devices, 6, 243, 1959.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: July 9, 1960

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27609
S/141/61/004/002/001/017
E140/E135

9,7100

AUTHORS: Akhmanov, S.A., and Roshal', A.S.

TITLE: Parametric subharmonic generators as ultra high speed digital computer elements

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1961, Vol.4, No.2, pp. 203-243

TEXT: The article constitutes a survey of the material published on the title subject up to March 1960. The authors consider that non-Soviet work, "particularly American", pays little attention to the theory of parametric oscillators. They consider that the investigations are basically empirical, which is "completely unjustified, if it is taken into account that already in the thirties the phenomenon of parametric excitation of electrical circuits had been studied in detail by Mandel'shtam, Papaleksi and their students". A section of the survey is therefore given over to this aspect of the question. The problems arising in further increase of digital computer speed consist in the following: 1) microwave trigger circuits - circuits with several stable states, characterized either by amplitude, phase or

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frequency of oscillation; 2) logical circuits, suitable for use at microwave frequencies and, in particular, in machines using amplitude, frequency or phase script; 3) miniaturization of economical and reliable devices. An Appendix discusses microwave devices for systems using amplitude script.
There are 22 figures and 91 references: 27 Soviet and 64 non-Soviet (of which up to 20 may be in Japanese). The four most recent English language references read as follows:

Ref.29: C.C. Messenger. A Review of Parametric Diode Research. Semiconductor Products, Vol.1, 17 (1960).
Ref.32: S.T. Eng, R. Solomon. Frequency Dependence of the Equivalent Series Resistance for a Germanium Parametric Amplifier Diode. Proc. IRE, Vol.48, 358 (1960).
Ref.46: R.T. Denton. A Ferromagnetic Amplifier Using Longitudinal Pumping. Proc. IRE, Vol.48, 937 (1960).
Ref.61: A.H. Solomon, F. Sterzer. Parametric Subharmonic Oscillator Pumped at 34 kMc/s. Proc. IRE, Vol.48, 1322(1960)

ASSOCIATION: Moskovskiy gosudarstvennyy universitet
(Moscow State University)

SUBMITTED: November 3, 1960

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S/141/61/004/002/011/017
E192/E382

9.4230 (1532)

AUTHORS: Akhmanov, S.A., Gorshkov, A.S. and Trofimenko, I.T.

TITLE: Frequency-division at Ultrahigh Frequencies by Means of Travelling-wave Tubes

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, 1961, Vol. 4, No. 2, pp. 309 - 318

TEXT: The problem of developing efficient and reliable frequency-dividers for the UHF range is still considered to be unsolved, in spite of the need for such devices. Frequency-dividers for these frequencies can be based on the same principle as those employed at radio frequencies. In general, it is required to develop dividers having comparatively large operating bandwidths. The authors are of the opinion that a a travelling-wave tube (TWT) with separate helices (see Fig. 1) can be used as a frequency-divider for UHF. In this device the electron beam passes through a number of helices which are used for wide-band amplification of different frequencies; the potential of each helix is chosen so as to obtain optimum interaction between the beam and the helix. The tube of Fig. 1

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consists of: 1 - electron gun; 2 - electron beam; 3, 4, 5 and 6 - delay helices and 7 - collector. The signals to be amplified can be applied to the inputs of various helices; in the same way, it is possible to effect mixing or multiplication. The separate portions of the tube can be bridged-over with external feedback circuits. The preceding "stages" can be used for injecting the signals which interact with the oscillations of the system. It is possible to eliminate almost completely the effect of the oscillations on the signal. A TWT with separate helices should, therefore, result in a flexible device permitting an efficient mixing of signals and it should have some advantages as compared with klystrons (Ref. 1 - Ye.N. Bazarov, M.Ye. Zhabotinskiy, Radiotekhnika i elektronika, 1956, 1, 680; Ref. 2 - H. Lyons - J. Appl. Phys., 21, 59, 1950). A regenerative frequency-divider and a resonance frequency-divider based on this type of tube were investigated experimentally. The regenerative frequency-divider or mixer gave a division ratio of 3:4, the input frequency being 4 200 Mc/s; this tube was in the form of

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a two-helix TWT. The first helix of the tube was used for wideband amplification (bandwidth of 600 Mc/s) of signals at frequencies around 4 000 Mc/s, while the second helix was employed for the amplification of signals in the frequency range 1 500 - 1 000 Mc/s. The signal and the local oscillator frequencies were applied to a common waveguide which was matched with the first helix; this helix was terminated with a matched load, whose function was to eliminate any tendency to self-excitation. The difference-frequency signal was obtained by means of a coaxial cable, which was matched with the output of the second helix. In the design of this frequency-divider or mixer attention was paid to the investigation of its transfer coefficient and its operating bandwidth. The experiments showed that it was possible to obtain operating conditions under which considerable gain could be obtained in the process. The transfer coefficient was between 15 - 20 db (and even 30 db) over a wide range of frequencies (a bandwidth of 400 Mc/s). The frequency characteristics of such a mixer are illustrated in Fig. 2. This shows the transfer coefficient of the mixer as a

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function of the input frequency f_1 signal and the difference frequency f_2. The local oscillator frequency for the experiment illustrated in this figure was f_r = 4 225 Mc/s; the collector current for the Curve (a) was 1.1 mA and for the other curve it was 1.8 mA. It was found from the experiments that the value of the transfer coefficient increased with increasing collector currents; however, at comparatively large currents it was possible to observe the regenerative effect. Optimum conditions with regard to maximum efficiency of the signal mixing were achieved when the operating voltage of the first helix was about 30 - 40 V lower than that corresponding to the maximum of the TWT gain. The overall conversion gain exceeded the gain of TWT in both the helices by at least 5 db. It had been shown earlier by one of the authors et al (Ref. 7 - Radiotekhnika i elektronika, 1960, 5, 1736) that the parametric effects could play a significant part in the operation of a TWT mixer. The difference-frequency of the mixer corresponds to the difference-frequency of a travelling-wave parametric amplifier. In fact, the parametric-amplification conditions represent an optimum for a TWT mixer. Consequently, the magnitude of the mixer transfer coefficient can be estimated on the basis of the formulae derived for the parametric wave-guide amplifying systems (Ref. 5 - P.K. Tien - J. Appl. Phys., 29, 1958, 1347; Ref. 6 -W. Loisell, G. Quate - Proc. IRE, 46, 707, 1958; Ref. 8 - W. Loisell - J. Electron. and Control, 6, 1, 1959). However, the overall transfer coefficient in an actual TWT mixer is determined by the frequency-conversion process as well as the gain in the first and second helices. The second divider is based on the resonance of the second kind and the harmonic locking effect. An experimental tube of this type was constructed. The first helix of this tube was used for injecting the signal to be divided into the electron beam, the frequency being 2f = 6 000 Mc/s; the second helix formed a delay system with an external feedback and was tuned to the frequency of f = 3 000 Mc/s. The frequency of the oscillator was primarily determined by the resonance frequency of the resonance circuit in the feedback loop, which suppressed the

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Frequency-division ....

undesired oscillation modes. Depending on the damping of the attenuator, which was connected in the feedback circuit, the operating conditions of the TWT could be such as to produce oscillations or potential instability (resonance of the second kind). This system has two advantages as compared with a klystron divider: 1) the signal to be divided is introduced into the electron beam by means of a separate helix and this results in an efficient interaction between the signal and the tube and permits a 40-50 db decoupling between the tube and the signal source; 2) the relative frequency drift of the divider can be made smaller than in the klystron. In particular, this drift can be made as low as 3×10^{-6} if the tube is supplied from a battery and the effective quality factor of its resonator is $Q_N = 3 \times 10^2$. The above results show that TWT frequency-dividers with separate helices have considerable advantages; in particular, it is possible to obtain large operating bandwidths. On the other hand, it should be pointed out that the harmonic locking effect and the resonance of the

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n-th kind is probably of little use in practice since this type of frequency-division can be efficiently performed by semiconductor diodes with nonlinear capacitance (Ref. 10 - D. Leenov, A. Uhlir - Proc. IRE, 47, 1724, 1959). The authors express their gratitude to D.K. Akulina for great help in this work and for discussing the results. The authors also thank S.D. Gvozdover for his constant interest in this work.
There are 5 figures and 11 references: 3 Soviet and 8 non-Soviet. Two of the four latest English-language references not quoted in the text are: Ref. 3 - R. de Grasse, G. Wade - Proc, IRE, 45, 1013, 1957 and Ref. 9 - C. Page, Proc. IRE, 46, 1738, 1958.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: July 1, 1960

AKHMANOV, S.A.

Concerning the effect of the fluctuations of the initial conditions on the process of establishing the oscillations in a generator with two steady states. Izv. vys. ucheb. zav.; radiofiz. 4 no.4:769-772 '61. (MIRA 14:11)

1. Moskovskiy gosudarstvennyy universitet.
(Oscillators, Electric)

AKHMANOV, S.A.; D'YAKOV, Yu.Ye.; ROMANYUK, A.K.; STRUKOV, M.M.

Stable wide-band generator with a nonlinear reactance. Prib.i tekh.eksp. 6 no.5:92-97 S-O '61. (MIRA 14:10)

1. Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta.
(Pulse techniques (Electronics))

30288
S/109/61/006/011/003/021
D246/D304

9.1400 (1144)

AUTHORS: Akhmanov, S.A., and Khokhlov, R.V.

TITLE: The transformation of random signals in non-linear lines

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 11, 1961, 1813 - 1824

TEXT: So far only regular signals have been studied in non-linear lines. The authors analyze the course of a weak random signal along a non-linear line which simultaneously passes a regular signal of finite amplitude. The basic equation representing such a line is

$$\frac{\partial^2 V}{\partial z^2} - L\frac{\partial^2 Q}{\partial t^2} - L\frac{\partial GV}{\partial t} - L\frac{\partial I}{\partial t} = 0 \qquad (3)$$

where G - conductivity. Introducing new variables:

$$\zeta = t + \frac{z}{u}, \qquad \eta = t - \frac{z}{u}, \qquad (5)$$

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assuming $V = V(\eta, \varepsilon\zeta)$, (6)
one obtains a solution (non-linear symbolic equations) for slowly varying amplitude V, and phase

$$\frac{\partial V_1}{\partial \zeta} - \beta V_p V_1 \cos 2\varphi + \delta(V_1) V_1 + F_1(\zeta) = 0, \quad (11a)$$

$$\frac{\partial \varphi}{\partial \zeta} + \gamma + \beta V_p \sin 2\varphi + \frac{1}{V_1} F_2(\zeta) = 0. \quad (11b)$$

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where $\beta = \frac{LDu^2\omega}{4}$; $\gamma = \frac{\omega}{4} u^2(\frac{1}{u^2} - LC)$ and the random forces $F_1(\zeta)$ and $F_2(\zeta)$ are

$$F_{1,2} = \frac{Lu^2}{2\omega} \cdot \frac{\omega}{\pi} \int_{-\frac{\pi}{\omega}}^{\frac{\pi}{\omega}} \dot{I} \begin{Bmatrix} \cos(\omega\eta + \varphi) \\ \sin(\omega\eta + \varphi) \end{Bmatrix} d\eta. \quad (13)$$

First the authors take the simple case of a "noiseless" line (external forces $F_{1,2} = 0$). Then (11b) can be solved independently. They examine the case when $\beta V_p > /\gamma/$ and consequently

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$$\cos 2\varphi_{est} > 0. \quad (18)$$

In this case the propagation of signal can be accompanied by the exponential increase of the amplitude. For the simple case of $\gamma = 1$, the expressions for the phase and amplitude are the following

$$\varphi = \mathrm{arc\ tg}[e^{2\beta V_p(\eta-\zeta)} \mathrm{tg}\,\varphi_0(\eta)] = \mathrm{arc\ tg}[e^{-4\beta V_p \frac{z}{u}} \mathrm{tg}\,\varphi_0(t - \frac{z}{u})], \quad (19)$$

$$V_1 = V_0\left(t - \frac{z}{u}\right)\sqrt{\cos^2\varphi_0\left(t - \frac{z}{u}\right) + \sin^2\varphi_0\left(t - \frac{z}{u}\right)e^{-8\beta V_p \frac{z}{u}}} \times \exp\left[\beta V_p - \delta(0)\right]\frac{2z}{u}. \quad (23)$$

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On this basis one may analyze the behavior of weak random signals. On the line they are functions of t & z. Assuming one known their distribution and correlation functions at $z = 0$, $W_0(\varphi_0)$ from (19) and (23) one can calculate them at any point. The authors show on a series of curves, that the phase of the output signal can take only one of two discrete values and the output amplitude is practically independent of the input amplitude. So the fluctuations of

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the input signal may show up at the output only in this choice of two possible stable states. Hence, from this relative time spent in that state, one may obtain information on the distribution function of the input signal which may serve as a basis for building a phase filter. The noise, produced by the line itself, however, may reduce this information; therefore the authors analyze separately the statistics of the phase of a weak signal in a "noisy" line. Introducing a quantitative measure for the loss of information

$$M = \frac{P_1(z) - P_2(z)}{P_1(0) - P_2(0)} \leqslant 1, \quad /M = 1 \text{ for a noisless line/} \tag{27}$$

where
$$P_{1,2}(z) = \int_{I,II} W_z(\varphi)\, d\varphi; \quad P_{1,2}(0) = \int_{I,II} W_0(\varphi_0) d\varphi_0. \tag{28}$$

The authors investigate the case, interesting for a phase filter, when $M \simeq 1$. Then the presence of the output phase in one of the stationary states is determined basically by the boundary conditions. The probability that a phase φ_0 at the input, will fall in a "strange" region (for $z \gg 1/8\, u/\beta V_p$) is

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$$\frac{1}{\sqrt{2\pi}}\int_{\frac{\varphi_0}{B}}^{\infty} e^{-y^2}\,dy, \qquad (42)$$

where

$$B = \frac{\sqrt{\overline{F_2^2}}}{2V_0}\,\frac{1}{\sqrt{\beta V_p}}. \qquad (43)$$

The condition

$$B^2 \leqslant 1 \qquad (51)$$

indicates what requirements the parameters of the line and amplitude of the weak signal have to satisfy in the construction of a phase filter. There are 3 figures and 11 references: 9 Soviet-bloc and 2 non-Soviet-bloc. The reference to the English-language publication reads as follows: P.K. Tien, J. Appl. Phys., 1958, 29,9 1347.

ASSOCIATION: Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo Universiteta im. M.V. Lomonosova (Faculty of Physics, Moscow State University im. M.V. Lomonosov)

SUBMITTED: March 31, 1961

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33698
S/106/62/000/002/004/010
A055/A101

9.2572 (1113, 1532)

AUTHORS: Akhmanov, S. A., D'yakov, Yu. Ye.

TITLE: On the stability of the frequency of a two-circuit parametric oscillator

PERIODICAL: Elektrosvyaz', no. 2, 1962, 26 - 31

TEXT: The possibility of using the two-circuit parametric oscillator for frequency stabilization is discussed. The authors begin by examining theoretically the self-excitation conditions for the two-circuit parametric oscillator; they derive a set of formulae giving the conditions under which parametric oscillations arise. They proceed next to an estimate (in linear approximation) of the factors determining the stability of the generated frequencies. They show that, under certain conditions, the influence of the drifts of the circuit parameters upon the generated frequencies is compensated, so that the stability of the frequency of the two-circuit oscillator can be considerably higher than the stability of the partial frequencies of the oscillating circuits. It is convenient to use the capacitance of the p-n junction as the nonlinear reactive element. An important advantage of the examined oscillator is also the possibility to do with-

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out electron tubes, which permits avoidance of such fluctuation sources as the flicker and the Schottky effects. The theoretical calculations and the formulae obtained by the authors were checked experimentally on super-high-frequency parametric oscillators. The capacitances of germanium semiconductor diodes with p-n junction were used as modulated capacitances. For comparatively low pumping powers (10 - 15 milliwatts on super-high-frequency and with a voltage of ~2 volts in the longwave range), it proved possible to obtain stable parametric oscillations; the loaded Q-factors (Q_1 and Q_2) of the circuits were ~50 - 70. The theoretical formulae were found to be in good agreement with the experimental results. At the end of the article, the authors express their thanks to professor S. D. Gvozdover, and also to A. K. Romanyuk and M. M. Strukov. There are 4 figures and 2 non-Soviet-bloc references. The references to the English-language publications read as follows: Heffner, Wade. Gain, bandwidth and noise characteristics of the variable parameter amplifier. J. Appl. Phys., 1958, v. 29, no. 9. Uhlir. The potential of semiconductor diodes in high-frequency communications. Proc. IRE, 1958, v. 46, no. 6.

SUBMITTED: May 28, 1960

S/141/62/005/001/015/024
E039/E135

9,2572

AUTHORS: Akhmanov, S.A., and Kravtsov, Yu.A.

TITLE: A two-circuit generator with a nonlinear capacity

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, v.5, no.1, 1962, 144-154

TEXT: The characteristics of a two-circuit parametric oscillator containing a nonlinear capacity as a control reactance are investigated. The parametric resonance curves, the form of the unstable regions, and the amplitude characteristics are calculated on the assumption that the limitation of a stationary amplitude is caused by the nonlinear capacity. Special attention is paid to the factors determining the frequency of the instabilities, in particular to the nonlinear correction to the frequency. The regimes where the nonlinear corrections have little influence on the frequency stability are indicated, and the stable phases of the output oscillations are discussed. Experiments were carried out on a two-circuit oscillator using a germanium diode, with a p—n transition, as the control capacity

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S/141/62/005/004/005/009
E192/E382

AUTHORS: Akhmanov, S.A. and Khokhlov, R.V.

TITLE: Trigger properties of nonlinear waveguide systems

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, v. 5, no. 4, 1962, 742 - 746

TEXT: Nonlinear waveguide systems possess switching properties which make it possible to design suitable spatial analogues of dynamic switching circuits with lumped parameters (such as amplitude, phase or frequency-modulated trigger circuits). The situation is illustrated by considering a line with a nonlinearly distributed capacitance which is simultaneously excited at the input end with a pump-signal frequency $\omega_H = 2\omega$ and a signal $\omega_c = \omega$. The line is described by the following differential equation:

$$\frac{\partial^2 V}{\partial z^2} - L \frac{\partial^2 Q}{\partial t^2} - L \frac{\partial GV}{\partial t} = 0 \qquad (1)$$

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where V is the voltage in the line,
L is the distributed inductance,
Q is the charge,
G is the conductivity,
z is the length, and
t is time.

The solution of Eq. (1) can be assumed to be in the form:

$$V = V_1(\varepsilon z)\sin\left[\omega t - \beta_1 z + \varphi_1(\varepsilon z)\right] + V_H \sin\left[2\omega t - \beta_2 z\right] \quad (2)$$

where ε is a small parameter, while β_1 and β_2 are wave numbers. If Q is assumed to be in the form:

$$Q(V) = CV + DV^2 \quad (3)$$

and the method of slowly changing amplitudes is applied to Eq. (1), the simplified amplitude and phase equations for the signal are in the form:

$$\frac{\partial V_1}{\partial z} + \left[\delta - m_o V_H \cos(2\varphi)\right] V_1 = 0 \quad (4)$$

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$$\frac{\partial \varphi}{\partial z} + \Delta + m_o V_H \sin(2\varphi) = 0 \qquad (5)$$

where $m_o = LDu\omega/4$, $\delta = LGu/4$ and u is the phase velocity of the signal wave. Eqs. (4) and (5) are analogous to the well-known simplified equations describing the variation in time of the amplitude and phase of the oscillations excited parametrically in a linear resonator (see, for example, Ref. 4. L.I. Mandel'shtam, N.D. Papaleksi, ZhTF, 3, 5, 1934 and Ref. 5. S.A. Akhmanov, Izv. vyssh. uch. zav. - Radiofizika, 4, 769, 1961). The parameter Δ in Eqs. (4) and (5) represents the attenuation and it is shown that the waves increase exponentially if:

$$\Delta < \sqrt{m_o^2 V_H^2 - \delta^2} .$$

The period T_1 occupied by one bit of information in such a system is expressed by:

$$T_1 \approx 1/2\omega . \qquad (9)$$

A similar switching system can be also based on a line whose conductivity is a function of voltage of the type:

$$G(V) = G_o - G_2V^2 + G_4V^4 \qquad (11).$$

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: December 20, 1961

S/141/62/005/005/011/016
E140/E135

AUTHORS: Akhmanov, S.A., and Roshal', A.S.

TITLE: Ternary trigger circuits with parametric oscillators

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Radiofizika, v.5, no.5, 1962, 1017-1025

TEXT: Parametron type circuits are used with threefold frequency division to obtain three stable phase relations. The resulting circuits are analysed theoretically and experimentally and some possible applications in computer techniques outlined. A note added in proof indicates that work has been published by Yu.A. Il'inskiy (Vestnik MGU 1962, series III, no.2, 60) on a similar circuit operating at the fourth subharmonic. There are 6 figures.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: August 5, 1961 initially, and after revision, February 5, 1962.

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AKHMANOV, S.A.; KOMOLOV, V.P.

Experimental study of fluctuation effects in establishing oscillations in an oscillator with two steady states. Izv.vys.ucheb. zav.; radiofiz. 5 no.6:1175-1186 '62. (MIRA 16:2)

1. Moskovskiy gosudarstvennyy universitet.
(Oscillators, Electric) (Electronic measurements)

AKHMANOV, S.A.; KHOKHLOV, R.V.

Space-time analogies in the theory of systems with variable parameters. Radiotekh. i elektron. 7 no.8:1453-1455 Ag '62. (MIRA 15:8)

1. Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta im. M.V.Lomonosova.

(Automatic control) (Electronics)

AKHMANOV, S.A.; YESHTOKIN, V.N.; MARCHENKO, V.F.

Methodology for measuring frequency fluctuation spectra of microwave generators. Radiotekh. i elektron. 7 no.12:2024-2032 D '62. (MIRA 15:11)

1. Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta im. M.V. Lomonosova.
(Microwave tubes) (Microwave measurements)

39679
S/056/62/043/001/054/056
B102/B104

24.3200

AUTHORS: Akhmanov, S. A., Khokhlov, R. V.

TITLE: A possibility of light wave amplification

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 1(7), 1962, 351-353

TEXT: Light waves may be generated and amplified in optical transparent crystals where the polarization is a nonlinear function of the field strength E of the propagating wave. Here it is shown that if this function is quadratic a parametric amplification of traveling light waves may occur. The medium considered is assumed to be semiinfinite, with

$$\varepsilon(t, x, \omega) = \varepsilon_0(\omega)\{1 + m[e^{i(\omega_H t - k_H x)} + e^{-i(\omega_H t - k_H x)}]\} \quad (2),$$

x being the normal to its surface plane. In this medium waves with the frequencies ω_1 and ω_2 are propagated, their components are $E_y = E; H_x; H_z$, with wave vectors cutting the x-axis at angles θ_1 and θ_2. The electric

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field in the medium is described by

$$\frac{1}{c^2}\frac{\partial^2 D}{\partial t^2} = \frac{\partial^2 E}{\partial z^2} + \frac{\partial^2 E}{\partial x^2}, \qquad D = \varepsilon E, \tag{3}$$

and the total field is

$$E = E_1(x)\exp\{i(\omega_1 t - \mathbf{k}_1\mathbf{r})\} + E_2^*(x)\exp\{-i(\omega_2 t - \mathbf{k}_2\mathbf{r})\} + \text{к. с.}, \quad k_l = \omega_l c^{-1}\sqrt{\varepsilon_0(\omega_l)}. \tag{4}$$

If $\omega_1 + \omega_2 = \omega_{ampl.}$, $\vec{k}_1 + \vec{k}_2 = \vec{k}_{ampl.}$, differential equations can be derived for determining the spatial amplitudes $E_{1,2}$. Since the modulation coefficient m is small ($\sim 10^{-4}-10^{-5}$), $d^2E_i/dx^2 \ll k_i dE_i/dx$ and

$$\frac{dE_1}{dx} = -\frac{im_1k_1}{2\cos\theta_1}E_2^*, \qquad \frac{dE_2^*}{dx} = \frac{im_2k_2}{2\cos\theta_2}E_1 \tag{6}$$

$$\frac{d^2E_1}{dx^2} = \frac{m_1m_2k_1k_2}{4\cos\theta_1\cos\theta_2}E_1 \quad (m_l = m(\omega_l)).$$

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Thus, in this medium waves may grow exponentially with a growth factor $\alpha = \frac{1}{2}\left[m_1 m_2 k_1 k_2/\cos\theta_1 \cos\theta_2\right]^{1/2}$. If for x = 0 $E_1 = E_0$ and $E_2 = 0$,

$$E_1 = E_0 \operatorname{ch} \alpha x,$$
$$E_2 = iE_0\sqrt{m_2 k_2 \cos\theta_1 / m_1 k_1 \cos\theta_2} \operatorname{sh} \alpha x. \qquad (7).$$

If $\omega_1 \approx \omega_2 = \omega$, $n(\omega) > n(2\omega)$. This amplification mechanism may be used in designing coherent optical generators with a reasonable efficiency. There is 1 figure.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: May 29, 1962

AKHMANOV, S.A.; ROSHAL', A.S.

Theory of transients in a parametrically excited circuit. Izv. vys. ucheb. zav.; radiofiz. 6 no.5:1008-1020 '63. (MIRA 16:12)

1. Moskovskiy gosudarstvennyy universitet.

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ACCESSION NR: AP3004377

S/0109/63/008/008/1428/1439

47

AUTHOR: Akhmanov, S. A.; Dmitriyev, V. G.

TITLE: On the saturation theory of a traveling-wave amplifier with a nonlinear reactance

SOURCE: Radiotekhnika i elektronika, v. 8, no. 8, 1963, 1428-1439

TOPIC TAGS: saturation-condition analysis, traveling-wave amplifier, nonlinear reactance, propagating-wave amplitude, attenuation, line loss, synchronization, phase velocity

ABSTRACT: Analysis of saturation conditions of a traveling-wave amplifier with nonlinear reactance operating in a given pumping field is presented. Two basic problems are examined: 1) the operation of the amplifier under nonlinear conditions without attenuation and 2) the effect of attenuation on processes occurring in the amplifier. It was found that the mechanism of saturation of such an amplifier has a great deal in common with the well known mechanism of TWT saturation. In both cases the approach to saturation conditions, which is determined by deviations from the condition of synchronism, has an oscillatory

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character. Consequently, saturation can be related either to the dependence of line losses on propagating wave amplitudes or to the break in synchronism of wave-phase velocities at large amplitudes. A phase-plane method and numerical integration are utilized to analyze nonlinear differential equations describing a change in the amplitude and phase characteristics of propagating waves. The power of a building-up wave at near-saturation conditions fluctuates, and the oscillation amplitude increases with an increase in the modulation factor of a reactive parameter and a decrease in the attenuation of the line. A brief discussion of the operation of the device under linear conditions is included. Results indicate that fluctuations of parameters such as propagation velocity and attenuation compensate each other. "The authors express their thanks to R. V. Khokhlov for valuable discussion and to S. D. Gvozdover for his interest in the project." Orig. art. has: 5 figures and 25 formulas.

ASSOCIATION: Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta im. M. V. Lomonosova (Faculty of Physics, Moscow State University)

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