SOV/106-58-4-8/16

Use of a Potential Analogue Method for the Design of Electrical Filters

Taking logs of (1):

$$\ln S = A + iB = \Gamma \quad (2),$$

where A - the working attenuation,
B - the working phase change,
Γ - the working transfer coefficient.

For the attenuation, we have:

$$A(\lambda) = \ln|S| = \ln\left|\frac{(\lambda - \lambda_1)(\lambda - \lambda_3)\ldots(\lambda - \lambda_{2n-1})}{(\lambda - \lambda_2)(\lambda - \lambda_4)\ldots(\lambda - \lambda_{2m})}\right| + \ln H \quad (3).$$

The potential function of a plane electrical field takes the form of an infinite conducting plane, such as a large electrolytic tank with a thin layer of electrolyte. Let two electrodes between which a current I_{γ} flows dip into the electrolyte.

Then the potential at any point M situated at a distance R_1 from the negative electrode and R_2 from the positive electrode

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is determined (Ref 2) by the formula:

$$U = \frac{I_{\partial}}{2\pi\gamma l} \ln \frac{R_1}{R_2} \qquad (4)$$

where γ is the conductance of the electrolyte, l is the depth of the electrolyte.
Two co-ordinates X and Y (Figure 1) are taken on the conducting plane and the electrolyte surface is considered as the plane of a complex variable:

$$z = x + iy .$$

Then the distance from the point M to the electrodes is determined by the following:

$$R_1 = \left| z - z_1 \right| , \qquad R_2 = \left| z - z_2 \right|$$

and substituting in (4), we obtain:

$$U = a \ln \left| \frac{z - z_1}{z - z_2} \right| \qquad (5)$$

where

$$a = \frac{I_э}{2\pi \gamma l} \qquad (6)$$

is a constant depending on the current in the electrodes and on the conductance and depth of the electrolyte. For a given number of electrode pairs, the potential at any point of the plane Z equals:

$$U(z) = a \ln \left| \frac{(z - z_1)(z - z_3)\dots(z - z_{2n-1})}{(z - z_2)(z - z_4)\dots(z - z_{2n})} \right| \qquad (7)$$

where $z_1, \dots, z_{2n-1}$ are the co-ordinates of the negative electrodes, $z_2, \dots, z_{2n}$ are the co-ordinates of the positive electrodes.

If the electrode co-ordinates are chosen so that they are numerically equal to the values of the zeros and the poles of the transfer function, then the analogy between expressions (3) and (7) is complete, except that in the denotation of the variables, the constant multiplier a and the additional term $\ln H$. Denoting the independent variable in both expressions by λ , i.e. assuming that the plane of the complex frequency coincides with the plane Z and solving simultaneously Eqs.(3) and (7), we obtain:

$$A(\lambda) = \frac{U(\lambda)}{a} + \ln H \qquad (8) .$$

For a reference level λ_o :

$$A(\lambda_o) = \frac{U(\lambda_o)}{a} + \ln H \qquad (9)$$

and subtracting Eq.(9) from (8), we have:

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Use of a Potential Analogue Method for the Design of Electrical Filters

$$A(\lambda) - A(\lambda_0) = \frac{U(\lambda) - U(\lambda_0)}{a} \qquad (10)$$

or

$$A = U/a \qquad (11)$$

where U is the potential difference measured in the electrolyte between the point λ and the reference point λ_0 . A is the difference in the working attenuation at frequencies corresponding to these points.
If the current in the electrodes is adjusted so that a equals unity, then A = U ,i.e. the potential difference in volts is numerically equal to the working attenuation in nepers. The current in each electrode must equal:

$$I_э = 2\pi\gamma l \qquad (12)$$

A simple method for determination of the frequency characteristic of the working attenuation can be devised on the basis of this mathematical analogue. Positive

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Use of a Potential Analogue Method for the Design of Electrical Filters

electrodes are placed on the complex frequency plane, which coincides with the electrolyte surface, at points corresponding to the poles of the transfer function and negative electrodes at points corresponding to the zeros of the transfer function. Equal currents determined by Eq.(12) are established in all the electrodes. Then the potential, measured along the real frequency axis relative to the co-ordinate origin will equal the working attenuation in nepers. Any given attenuation can be obtained by changing the positions of the electrodes. Then knowing the zeros and poles, the four-terminal network for the given attenuation can be determined.

The character of the field for a half-section of a low-frequency k type filter is determined and an equation for an ellipse is obtained. Thus, the lines of equal attenuation of a k type half-section will be ellipses. In the potential analogue equipotential lines correspond to lines of equal attenuation. Any equipotential line can act as an electrode and the most convenient electrode will be a plane electrode placed in the electrolytic tank along the real frequency axis from $-i\omega_1$ to $+ i\omega_2$. An

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infinitely distant point can serve for the other electrode, for which the frame of an electrolytic tank of large dimensions can be used. In this case, the electric field will be as shown in Figure 2. The current lines shown dotted are everywhere orthogonal to the equipotential lines, shown in full and form a family of co-focal hyperbolae with focii $\pm i\omega_1$.

To determine the frequency-attenuation characteristic of the type k half-section, the potential along the real frequency axis relative to the plane electrode is measured by a cathode voltmeter. If the attenuation of the full type k section is required, then the current in the electrodes must be doubled.

For a type m section, the characteristic transfer constant is determined by the formula:

$$\mathrm{sh}\,\frac{\Gamma_m}{2} = \sqrt{\frac{Z_{1m}}{4Z_{2m}}} \qquad (19)$$

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Use of a Potential Analogue Method for the Design of Electrical Filters

Again, hyperbolic sinusoidal functions are presented with the difference that the right-hand side reaches an infinitely great value not when $\lambda = \infty$, but at a specific finite frequency:

$$\lambda_{\infty} = \pm \frac{i\omega_1}{\sqrt{1-m^2}} = \pm\ i\omega_{\infty} \tag{20}$$

corresponding to the attenuation pole of the type m section.

To measure the frequency characteristic of the type m section, it is necessary to put one electrode at the point $+i\omega_{\infty}$ and the other at the point $-i\omega_{\infty}$. Current of strength $I_э$ is passed through each electrode and the total current $2I_э$ passes through the plane electrode disposed along the segment $-i\omega_1$, $+i\omega_1$. The potential relative to the plane electrode measured by a cathode voltmeter along the real frequency axis will be proportional to the

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characteristic attenuation of the m type section. If the filter consists of several m type sections, then electrodes are placed in the electrolytic tank at points on the real frequency axis corresponding to the attenuation poles of the individual sections (Figure 3). The same current $I_э$ flows in all the electrodes. Then the potential relative to the plane electrode in volts measured along the real frequency axis will equal the summated attenuation of the filter in nepers.

To avoid errors due to the finite dimensions of the electrolytic tank and the physical positioning of the electrodes, it is convenient to transform the complex frequency plane into a rectangle (Ref 3) by using an elliptical integral of the first order. This transformation is written in the form of an elliptical sine function.

Then, the whole plane of the complex frequency is transformed into rectangles on the Z plane (Figure 3).

In view of the symmetry, it is sufficient to consider only one quadrant transformed into a rectangle on the plane Z with sides K and K' (Figure 4).

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Use of a Potential Analogue Method for the Design of Electrical Filters

The apparatus is illustrated in Figure 5. The base of the tank is a polished sheet of glass 60 x 70 cm and 4 - 5 mm thick. Four plexiglass or ebonite plates, 15 - 20 mm, 5 - 6 mm thick, are fixed to the glass and form the electrolytic tank. The width of the tank corresponds to the side K and equals, for example, $X_k = 50$ cm. The height of the bath corresponding to side K' equals:

$$Y_{K'} = 50 \frac{K'}{K} \text{ cm} \qquad (27)$$

The upper movable plate corresponding to the stop band is fixed in accordance with this dimension. Tap water was used for the electrolyte and the depth was 3 - 4 mm. Thin sewing needles or copper wires 0.5 - 0.6 mm diameter were used for the electrodes. A strip of copper foil secured by screws to the lower fixed plate of the tank formed the plane electrode. The co-ordinates X and Y were read off directly in mm from graph paper under the glass. To avoid polarisation of the electrodes, a 1 000 c.p.s. generator (types 3G-2A or 3G-10) with a 60 V output was used.

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Use of a Potential Analogue Method for the Design of Electrical Filters

For measurement of the potential relative to the plane electrode, a valve voltmeter of type VKS-7B was used. The potential drop across 300 Ω resistors connected in series with each electrode was measured by a high impedance input meter, thereby obtaining the current value.
The current in each electrode is adjusted to agree with Eq.(12) and then the voltmeter reading in volts is equal to the attenuation in nepers at the corresponding frequency. It is necessary to remember that the current in the electrodes in the transformed plane is two times less than in the plane Λ (Figure 4) and therefore formula (12) takes the form:

$$I_{э} = \pi\gamma l \qquad (28).$$

The elentrode current is, in practice, within the limits 0.5 to 1.5 mA, depending on the salt content of the water and on the depth of the electrolyte.
In Figure 6 is produced the curve of the characteristic attenuation of a filter of class 3, 5 constructed from

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Use of a Potential Analogue Method for the Design of Electrical Filters

measurements taken in an electrolytic tank. There is good agreement between experimental and calculated results. There are 6 figures, 1 table and 6 references, 3 of which are Soviet, 1 German and 2 English.

SUBMITTED: March 11, 1957

Card 13/13 1. Electric filters--Design 2. Mathematics--Applications

SOV/106-58-12-7/13

AUTHOR: ~~Ufel'man, A.F.~~

TITLE: A Theorem on the Mean Value of the Attenuation in the Stop-Band of a Filter (Teorema o srednem znachenii zatukhaniya v polose zaderzhivaniya fil'tra)

PERIODICAL: Elektrosvyaz', 1958, Nr 12, pp 49 - 57 (USSR)

ABSTRACT: At the present time, the design of electrical filters is based on the simplest case when the required attenuation in the stop-band or in part of the stop-band is constant. In practice, the requirements are often different: in one part of the band, high attenuation is required, but in other parts the attenuation may be significantly less. In these cases, to design the filter giving a guaranteed constant minimum attenuation is uneconomical. The article develops a new theorem, from which simple design formulae can be derived, enabling the optimum filter design to be obtained quickly and accurately. The theorem is formulated as follows: "The mean value of the characteristic attenuation in the stop-band of a filter expressed in terms of an elliptical frequency scale remains constant for a given class of filter with any given distribution of the infinite-

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SOV/106-58-12-7/13

A Theorem on the Mean Value of the Attenuation in the Stop-Band of a Filter

attenuation frequencies". The article commences with the results obtained by the author (Ref 1) who showed that the complex frequency plane is transformed into rectangles on the z-plane by the expression:

$$\Lambda = i\ \mathrm{sn}(z, k),$$

where $\Lambda = \Sigma + i\Omega$ - normalized complex frequency,

$\Omega = f/f_1$ - normalized frequency,

f - cut-off frequency.

The design formulae derived are also applicable to the working attenuation, but the proof of this is to be the subject of a separate article.

There are 3 figures, 1 table and 3 Soviet references.

SUBMITTED: March 21, 1958.

Card 2/2

UFEL'MAN, A.F., assistent

Zlotarev's fraction and its use in designing filters by means of characteristic parameters. Sbor. LIIZHT no.158:387-408 '58. (MIRA 11:6)

(Electric filters)

UFEL'MAN, A.F., inzh.

Generalized theory used in designing electric filters. Sbor. LIIZHT no.161:13-42 '58. (MIRA 11:12)
(Electric filters)

UFEL'MAN, A.F.

Generalized theory on Chebyshev reactive filters. Izv. vys. ucheb. zav.; radiotekh. 2 no.6:679-693 N-D '59. (MIRA 13:6)

1. Rekomendovana kafedroy elektrosvyazi Ural'skogo elektromekhanicheskogo instituta inzhenerov zheleznodorozhnogo transporta.

(Electric filters)

AUTHOR: Ufel'man, A.F. SOV/106-59-7-9/16

TITLE: The General Law for the Position of the Roots of the Characteristic Polynomial in the Complex Frequency Plane for the Design of Filters for the "Working" Parameters

PERIODICAL: Elektrosvyaz', 1959, Nr 7, pp 57 - 65 (USSR)

ABSTRACT: The "working" parameters of a four-terminal network, consisting of a finite number of lumped elements, can be expressed by three real polynomials, f, g, h of the complex frequency $\lambda = \sigma + i\omega$:

$$S = \frac{g}{f}, \quad W = \frac{g + h}{g - h} \qquad (1)$$

where S is the working transfer coefficient;
W is the normalised input impedance.

Also:

$$e^{2A} = 1 + |\varphi|^2 \qquad (2)$$

where $A = \log|S|$ is the working attenuation of the four-terminal network;
$\varphi = h/f$ is the "filtration" function.

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The General Law for the Position of the Roots of the Characteristic Polynomial in the Complex Frequency Plane for the Design of Filters for the "Working" Parameters

For reactive four-terminal networks, the polynomials are related by:

$$g(\lambda)g(-\lambda) = f(\lambda)f(-\lambda) + h(\lambda)h(-\lambda) \qquad (3) .$$

The polynomials f, g, h are the simplest and most universal characteristics of a four-terminal network since, if these polynomials are known, both the working and characteristic parameters of the network can be found and also its circuit determined.

The problem of synthesis of an electric filter according to its working attenuation consists of finding a filter circuit with the minimum number of elements to give a working attenuation in the passband smaller than some value A_{max} and in the stopband greater than A_{min} .

This problem can be divided into three parts:

1) The problem of finding the best approximation to the given requirements of the working attenuation, using a

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fractional rational $\varphi = h/f$ of the lowest possible degree.

2) Determination of the polynomial $g(\lambda)$ by Eq (3).

3) Determination of the filter circuit according to the polynomials found (f, g, h).

The first and third problems have been examined in the references quoted but determination of the polynomial $g(\lambda)$ presents great difficulty. The roots of the polynomial $g(\lambda)$ are equal to the roots of the characteristic equation of the system and correspond to the frequencies of free oscillations which can arise in a loaded four-terminal network. Therefore, $g(\lambda)$ is called the characteristic polynomial of the four-terminal network. Since in passive four-terminal networks, the free oscillations must decay, the real part of the roots of $g(\lambda)$ must be negative. This enables the polynomial $g(\lambda)$ to be determined by the known roots of the righthand part of Eq (3); all the roots with a negative real part correspond to the polynomial

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The General Law for the Position of the Roots of the Characteristic Polynomial in the Complex Frequency Plane for the Design of Filters for the "Working" Parameters

$g(\lambda)$ and with a positive real part the polynomial $g(-\lambda)$. Thus, the entire problem is to find the roots of the righthand part of Eq (3). A method is developed in the article for finding the roots of the characteristic polynomial, based on using the special properties of the "filtration" function, which for filters is a rational Chebyshev function. The properties of Chebyshev functions enable these functions to be used for the design of electrical functions. Other conditions being equal, they ensure the maximum possible working attenuation in the stop-band. The Chebyshev functions can be simply represented by a "comparison" filter, which is a filter in which the characteristic attenuation poles coincide with the poles of the given Chebyshev function. Figure 5 shows a Chebyshev function of the fifth degree obtained by using a comparison filter, consisting of two m-type sections and one k-type half-section.

Card4/6 It is shown that rational Chebyshev functions can be uniquely

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The General Law for the Position of the Roots of the Characteristic Polynomial in the Complex Frequency Plane for the Design of Filters for the "Working" Parameters

represented by using a comparison filter. On this basis a general law for the distribution of the roots of the characteristic polynomial in the complex frequency plane is found. The roots of the polynomial $g(\lambda)$ are situated in the left half of the Λ-plane at points of intersection of the lines of equal attenuation of the comparison filter at which the characteristic attenuation equals:

$$A_N = \mathrm{Ar\,sh} \frac{1}{\sqrt{e^{2A_{max}} - 1}}$$

with the lines of equal phase, which unite each pole of the Chebyshev function with the corresponding zero.
Using the conform transformation of the complex frequency plane, the exact design formulae for determination of the roots can be obtained for the case when the filtration is a Zolotarev fraction and the simple approximation

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The General Law for the Position of the Roots of the Characteristic Polynomial in the Complex Frequency Plane for the Design of Filters for the "Working" Parameters

formulae for the general case when the filtration function is a Chebyshev fraction.

There are 3 figures and 10 references, of which 7 are Soviet, 2 German and 1 American.

SUBMITTED: March 10, 1959

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UFEL'MAN, A. F.

В. В. Шлигер

Электронная АТС на 10 номеров с пространственным разделением каналов.

Г. А. [illegible]

Использование элементов бесконтактной коммутации в цепях управления координатными АТС.

О. Н. Иванова

Анализ бесконтактных схем пробы при свободном и вынужденном искании для квазиэлектронных МТС.

М. Я. Покрасс

Некоторые дополнительные возможности образования электронных АТС.

В. А. Гриневич,
З. С. [illegible]

Анализ бесконтактных способов подключения соединительных линий к регистрам.

9 июня

(с 18 до 22 часов)

В. А. [illegible]

Аппаратура открытой автоматической междугородной телефонной связи.

Г. П. [illegible]

О методах решения систем уравнений состояния для двухкаскадных телефонных схем.

Г. З. [illegible]

Применение бесконтактных элементов для коммутации в аппаратуре КРР.

10 июня

(с 10 до 16 часов)

К. П. Егоров

Новая система уплотнения цепей внутрирайонной связи.

С. С. Коган

Магнитострикционные фильтры для многоканальных систем дальней связи

А. К. [illegible]

Нелинейные помехи в междугородном канале коаксиального кабеля при совместной передаче телефонных и телевизионных сигналов.

А. Ф. Уфельман

Синтез электрических фильтров по рабочим параметрам.

report submitted for the Centennial Meeting of the Scientific Technological Society of Radio Engineering and Electrical Communications im. A. S. Popov (VNORiE), Moscow, 8-12 June. 1959

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A055/A133

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AUTHOR: Ufel'man, A.F.

TITLE: Determination of the roots of the characteristic polynomial of Chebyshev filters

PERIODICAL: Elektrosvyaz', no. 3, 1960, 44 -51

TEXT: In a previous work [Ref. 3: Raschet elektricheskikh filtrov s pomoshch'yu potentsial'noy analogii. Kandidatskaya dissertatsiya. (Calculation of electrical filters with the aid of potential analogy. Candidate's Dissertation.) LIIZhT, 1957], the author showed that if the filtration function is a Zolotarev fraction, the disposition of the characteristics polynomial roots proves to be the simplest in the conformally transformed plane z related to the complex frequency plane by the equation: $\Lambda = i\,sh\,(z, k)$, (2) where $\Lambda = \Sigma + i\Omega$ is the normalized complex frequency; $\Omega = \frac{\omega}{\omega_1} = \frac{f}{f_1}$ is the normalized frequency; $k = \frac{f_1}{f_2}$ is the cutoff steepness, f_1 is the boundary frequency of the pass band and f_2 the boundary frequency of the cutoff band. The arrangement of the roots in plane z becomes particularly clear if potential analogy is used. In his previous work, the author showed that the equi-attenuation lines in plane Λ correspond to equi-

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potential lines in an electrolytic tank, and that equiphase lines correspond to current lines. The roots of the polynomial g (Λ) are located in the intersection points of the equipotential line U = A_N with the mean current lines starting from each electrode. In the case of a Zolotarev fraction, the mean current lines are parallel to axis y and the equipotential line U = A_N is parallel to axis x. The purely experimental method of determining the roots of the polynomial g (Λ), such as it is described by Boothroyd, proved very labor-consuming and insufficiently accurate. The author suggests, therefore, an analytical approximate method based upon the following postulates: 1) In plane z, the characteristic line is considered a straight line and is, therefore, determined by two points (0, y_Σ) and (K, y_Ω), corresponding to the characteristic frequencies Σ_N and Ω_N. 2) The equiphase lines intersect the characteristic line and the x-axis at right angles and are consequently assimilated to circle-arcs with the center located in the intersection point of the prolonged characteristic line with the x-axis. The intersection points with the x-axis of the equiphase lines on which the roots of the polynomial g (Λ) located are the zeros of the Chebyshev fraction. The characteristic frequencies Σ_N and Ω_N at which the attenuation of the comparison filter is equal to A_N can also be easily determined. The determination of the ordinates y_Σ and y_Ω is particularly simple if potential analogy is used. The slope of the characteristic line is determined by: $tg\gamma = \frac{\Delta y}{K}$, $\Delta y = y_\Sigma - y_\Omega$, (3) where K is the full elliptical integral of the first kind with modulus k. The shift of the abscissae of the roots of Λ with respect to the zeros of the Chebyshev fraction x is $\Delta x_\nu = R_\nu - R_\nu \cos\gamma$, (4) where $R_\nu = a + (K - x_{0\nu})$, (5). Substituting the radius of curvature R_ν in (4), the author obtains:

$$\Delta x_\nu = K(1 - \cos\gamma)\left(\frac{y_\Omega}{\Delta y} + 1 - \frac{x_{0\nu}}{K}\right). \quad (6)$$

The coordinates of the roots of the characteristic polynomial in plane z are determined by the following formulae: $x_\nu = x_{0\nu} + \Delta x_\nu$, (7); $y_\nu = y_\Omega + \Delta y\left(1 - \frac{x_\nu}{K}\right)$ (8). This method can be named the "three points method". Substitution of the thus found values of the coordinates $z_\nu = x_\nu + i\, y_\nu$ in (2) results in: $\Lambda_\nu = \Sigma_\nu + i\,\Omega_\nu = i\,\mathrm{sn}\,(x_\nu + i\,y_\nu, k)$, (9). Starting from this formula, it is easy to obtain the roots of the polynomial g (Λ):

$$\Sigma_\nu = -\frac{\mathrm{cn}\,x\,\mathrm{dn}\,x\,\mathrm{sn}\,y\,\mathrm{cn}\,y}{\mathrm{cn}^2 y + (k\,\mathrm{sn}\,x\,\mathrm{sn}\,y)^2}, \quad (10); \qquad \Omega_\nu = \frac{\mathrm{sn}\,x\,\mathrm{dn}\,y}{\mathrm{cn}^2\,y + (k\,\mathrm{sn}\,x\,\mathrm{sn}\,y)^2}. \quad (11)$$

Formulae (10) and (11) require, however, a labor-consuming interpolation and are, therefore, difficult to use. Using transformations, the author obtains:

$$\Sigma_0 = -T_\nu \frac{b_\nu}{1 + a_\nu}, \qquad \Omega_\nu = S_\nu \frac{c_\nu}{1 + a_\nu}. \quad (12)$$

where $S_\nu = \text{sn}(x_\nu, k)$, $T_\nu = \text{tn}(y_\nu k')$, (13); $a_\nu = k^2 T_\nu^2 S_\nu^2$, $b_\nu = \sqrt{(1 - S_\nu^2)(1 - k^2 S_\nu^2)}$, (14); $c_\nu = \sqrt{(1 + T_\nu^2)(1 + k^2 T_\nu^2)}$, (15). S_ν can be expressed in terms of the Chebyshev fraction zeros $\Omega_{0\nu}$, and T_ν in terms of Σ_N and Ω_N with the aid of the following formulae (derived by the author in an appendix to the article): $S_\nu = \Omega_{0\nu} + \Delta x_\nu b_{0\nu}$, (16); $T_\nu = \Sigma_N - (\Sigma_N - T_\Omega)\frac{x_\nu}{K}$, (17); where $b_{0\nu} = \sqrt{(1 - \Omega_{0\nu}^2)(1 - k^2 \Omega_{0\nu}^2)}$, (18); $T_\Omega = \sqrt{\frac{\Omega_N^2 - 1}{1 - k^2 \Omega_N^2}}$, (19)

The roots of polynomial g (Λ) can thus be determined with the aid of formulae (12) if the following magnitudes are known: the zeros of the Chebyshev fraction $\Omega_{0\nu}$, the characteristic frequencies Σ_N and Ω_N, and the abscissae shift Δx_ν in plane z [calculated with formula (6)]. The accuracy of formulae (12) depends on the magnitude of the shift of the attenuation poles from the "iso-extremal" position. When this shift is equal to zero, $\Delta x_\nu = 0$; $S_\nu = \Omega_{0\nu}$; $T_\nu = \Sigma_N$, and formulae are obtained that are accurate for cases when the filtration function is a Zolotarev fraction. It is possible to simplify the above derived formulae by eliminating Δx_ν from (16) and x_ν from (17). Resorting to the relation:

$$\frac{x_\nu}{K} \approx \frac{n - (2\nu - 1)}{n}. \quad (21)$$

where n is the power of the Chebyshev fraction, and substituting (21) in (17), the author obtains:

$$T_{0\nu} = \sum_N - \left(\sum_N - T_\Omega\right) \frac{n - (2\nu - 1)}{n} \quad (22)$$

The correction Δx_ν, $b_{0\nu}$ in (16) does not represent more than 1 - 2 %; therefore, it is possible to state that: $S_\nu \approx \Omega_{0\nu}$. Taking all this into consideration, the author writes the simplified formulae for the determination of the polynomial roots as follows:

$$\sum_\nu = - T_{0\nu} \frac{b_{0\nu}}{1 + a_{0\nu}}, \qquad \Omega = \Omega_{0\nu} \frac{c_{0\nu}}{1 + a_{0\nu}}, \quad (23)$$

where:

$$a_{0\nu} = k^2 T_{0\nu}^2 \Omega_{0\nu}^2 \quad (24) \qquad \text{and} \qquad c_{0\nu} = \sqrt{(1 + T_{0\nu}^2)(1 + k^2 T_{0\nu}^2)}. \quad (25)$$

Having established these formulae, the author applies them in a numerical example, and, finally, draws the following conclusions: When approximate formulae (23) are used for the calculation (with the aid of a slide-rule), the error varies within 0.5÷5 % depending on the degree of the irregularity of the conditions set on the oparating attenuation in the cutoff-band of the filter. When this irregularity μ is below 0.05, the roots must be calculated using formulae (12) (with the aid of an arithmometer) or formula (10) and (11) (with the aid of elliptical function tables). If the irregularity is large, the error with formulae (12) can reach 1 - 3 %. In that case, it is necessary to render the determination of the roots more precise resorting to one of the well-known methods, for instance to that described by Cauer [Ref. 6:"Theorie der linearen Wechselstromschaltungen", Berlin, 1954). There are 4 figures and 7 references, 4 Soviet-bloc and 3 non-Soviet-bloc. The 2 English language references are: Boothroyd. "Design of electric wave filters with the aid of the electrolytic tank." Proc. IEE., part IV, oct. 1951. Spencely. Smithsonian elliptic function tables. Washington, 1947.

SUBMITTED: June 27, 1959.

81379

S/108/60/015/05/07/008
B007/B014

9.3230

AUTHOR: Ufel'man, A. F.

TITLE: Synthesis of Electric Filters According to the Operating Parameters and With the Aid of Zolotarëv's Fraction

PERIODICAL: Radiotekhnika, 1960, Vol. 15, No. 5, pp. 64-72

TEXT: The method of calculating filters according to the operating parameters and with the aid of Ye. I. Zolotarëv's isoextreme functions was developed by S. Darlington (Ref. 1) in 1939. Because of its complexity this method has not been applied. A. Grossman (Ref. 2) used the series of the ϑ-functions to eliminate the elliptical functions from Darlington's formulas. However, also these formulas proved to be very extensive. The author of the present paper suggests simpler formulas for the calculation of filters. The special functions were eliminated by using E. Glowatzki's tables (Ref. 3). Thus, work could be largely reduced as compared to A. Grossman's formulas. Formula (1) is written down for the attenuation of some reactance four-terminal network consisting of linear lumped elements (Refs. 1, 4, and 5):

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Synthesis of Electric Filters According to the Operating Parameters and With the Aid of Zolotarëv's Fraction

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B007/B014

$e^{2A} = 1 + |\varphi|^2$, $A = \ln|S|$ - attenuation, $S = \frac{g(\lambda)}{f(\lambda)}$ - transmission coefficient, $\varphi = \frac{h(\lambda)}{f(\lambda)}$ - filtration function, f, g, and h - real polynomials of the complex frequency $\lambda = \sigma + i\omega$. If f, g, and h are known, it is possible to find all parameters of the reactance four-terminal network and to determine its circuit. The electric filter is set up according to the attenuation in the following way: A filter circuit with the least number of elements is to be found, and the elements are used to prevent the attenuation from exceeding the rated value of A_{max} within the range of transmission and from falling below the rated value of A_{min} within the attenuation band. The three parts of the problem are enumerated: 1) determination of the filtration function $\varphi = \frac{h}{f}$, 2) determination of the roots of the characteristic polynomial $g(\lambda)$; 3) determination of the filter circuit from the resulting polynomials

Card 2/3

Synthesis of Electric Filters According to the Operating Parameters and With the Aid of Zolotarëv's Fraction

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f, g, and h. Next, the author describes the calculation of a standard low-frequency filter from which filters of the upper frequencies and band filters are obtained by means of frequency transformation. This calculation is illustrated by an example. It requires about as many operations as the calculation according to the characteristic parameters, but the quality of the filters is considerably improved. Mention is made of the Zobel filters and the general methods by P. L. Chebyshev. There are 2 figures and 13 references: 7 Soviet, 4 English, and 2 German.

SUBMITTED: May 4, 1959 (initially) and
May 21, 1959 (after revision)

Card 3/3

UFEL'MAN, A.F.

Scientifically based study programs for training specialists in the field of radio engineering. Izv. vys. ucheb. zav.; radiotekh. 3 no.4: 520-521 Jl-Ag '60. (MIRA 13:10)

1. Kafedra elektrosvyazi Ural'skogo elektromekhanicheskogo instituta inzhenerov zhelezno-dorozhnogo transporta.
(Radio--Study and teaching)

KAPELINSKIY, Yu.N.; POLYANIN, D.V.; MENZHINSKIY, Ye.A.; IVANOV, I.D.; SERGEYEV, Yu.A.; KOSTYUKHIN, D.I.; DUDUKIN, A.N.; IVANOV, A.S.; FINOGENOV, V.P.; ZAKHMATOV, M.I.; SOLODKIN, R.G.; DUSHEN'KIN, V.N.; BOGDANOV, O.S.; SEROVA, L.V.; GONCHAROV, A.N.; KARKHIN, G.I.; LYUBSKIY, M.S.; PUCHIK, Ye.P.; SEROVA, L.V.; KAMENSKIY, N.N.; SABEL'NIKOV, L.V.; FEDOROV, B.A.; GERCHIKOVA, I.N.; KARAVAYEV, A.P.; KARPOV, L.N.; SHIPOV, Yu.P.; VLADIMIRSKIY, L.A.; KUTSENKOV, A.A.; RYABININA, E.D.; ANAN'YEV, P.G.; ROGOV, V.V.; BELOSHAPKIN, D.K.; SEYFUL'MULYUKOV, A.M.; PARFENOV, A.Ya.; SMIRNOV, V.P.; ALEKSEYEV, A.F.; SHIL'DKRUT, V.A.; CHURAKOV, V.P.; BORISENKO, A.P.; ISUPOV, V.T.; ORLOVA, N.V., red.; GORYUNOVA, V.P., red.; BELOSHAPKIN, D.K., red.; GEORGIYEV, Ye.S., red.; KOSAREV, Ye.A., red.; KOSTYUKHIN, D.I., red.; MAYOROV, B.V., red.; PANKIN, M.S., red.; PICHUGIN, B.M., red.; POLYANIN, D.V., red.; SOLODKIN, R.G., red.; UFIMOV, I.S., red.; EKHIN, P., red.; SMIRNOV, G., tekhn.red.

[Economy of capitalist countries in 1957] Ekonomika kapitalisticheskikh stran v 1957 godu. Pod red. N.V.Orlova, IU.N.Kapelinskogo i V.P.Goriunova. Moskva, Izd-vo sotsial'no-ekon.lit-ry, 1958. 686 p. (MIRA 12:2)

1. Moscow. Nauchno-issledovatel'skiy kon"yunkturnyy institut. (Economic conditions)

POTEKHIN, I.I., glav. red.; BARANOV, A.N., red.; BELYAYEV, Ye.A., red.; GELLER, S.Yu., red.; GRAVE, L.I., st. nauchnyy red.; GRIGOR'YEV, A.A., red.; GUBER, A.A., red.; KULAGIN, G.D., red.; MALIK, Ya.A., red. MANCHKHA, P.I., red.; MILOVANOV, I.V., red.; NERSESOV, G.A., red.; OL'DEROGGE, D.A., red.; ORLOVA, A.S., red.; POPOV, K.M., red. ROZIN, M.S., kand. ekon. nauk, red.; SMIRNOV, S.R., red.; UFIMOV, I.S., red.; SHVEDOV, A.A., red.; YASTREBOVA, I.P., red.; PAVLOVA, T.I., tekhn. red.

[Africa; encyclopedia] Afrika; entsiklopedicheskii spravochnik. Glav. red. I.I.Potekhin. Chleny red. kollegii: A.N.Baranov i dr. Moskva, Vol.1. A - L. 1963. 474 p. (MIRA 16:4)

1. Sovetskaya entsiklopediya, Gosudarstvennoye nauchnoye izdatel'stvo, Moscow.

(Africa--Dictionaries and encyclopedias)

UFIMTSEV, A.M., inzh.

Testing of water-wheel generators. Elek.sta. 29 no.5:49-51 My '58. (MIRA 12:3)

(Electric generators--Testing)

UFIMTSEV, A.M., inzh.

Increase of hydrogen pressure in TV2-100-2 and TV-50-2 turbogenerators. Energetik 10 no.1:19-22 Ja '62. (MIRA 14:12)

(Turbogenerators)

UFIMTSEV, A.M., inzh.; LEBEDEV, A.T., inzh.

Testing of turbogenerators in asynchronous operation. Elek. sta. 33 no.8:28-32 Ag '62. (MIRA 15:8)
(Turbogenerators—Testing)

UFIMTSEV, A.M., inzh.

Results of testing TVF-200-2 turbogenerators. Elek. sta. 34 no.8:67-69 Ag '63. (MIRA 16:11)

S/139/60/000/03/042/045
E032/E314

AUTHORS: Vorob'yev, A.A., Savintsev, P.A. and Ufimtsev, B.F.

TITLE: The Ionisation Potentials of Atoms and the Mutual Solubility of Metals

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No 3, pp 233 - 234 (USSR)

ABSTRACT: Depending on the type of interaction between the components, fused metals can form various types of alloys, e.g. eutectic mixtures, solid solutions or chemical compounds. It is well known that there is a definite periodicity in the ionisation potentials of elements, depending on their position in the periodic table. It is argued that intermetallic compounds are formed when the ionisation potentials of the two metals are considerably different. Conversely, in the case of eutectic alloys, the ionisation potentials of the components are roughly the same. Solid solutions are formed when the difference between the ionisation potentials of the components approach a certain average value. These ideas are illustrated in Table 1, in which eutectic alloys are shown on the left and solid solutions

Card1/2

The Ionisation Potentials of Atoms and the Mutual Solubility of Metals

on the right. φ_1 and φ_2 are the ionisation potentials and $\Delta\varphi$ is the difference between them.
There are 1 table and 2 Soviet references.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M. Kirova (Tomsk Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: October 26, 1959

Card 2/2

SAVINTSEV, P.A.; UFIMTSEV, B.F.

Contact melting of multicomponent organic systems. Izv. TPI 105:215-217 '60. (MIRA 16:8)

1. Predstavleno nauchnym seminarom radiotekhnicheskogo fakul'teta Tomskogo ordena Trudovogo Krasnogo Znameni politekhnicheskogo instituta imeni Kirova.

(Melting)

UFIMTSEV, F.

Great changes. Mast.ugl. 5 no.4:10-12 Ap '56. (MLRA 9:7)

1.Nachal'nik Bachatskogo razreza kombinata Kuzbassugol'.
(Kuznetsk Basin--Ship mining)

UFIMTSEV, G. N.

Proyektirovaniye promyshlennykh predpriyatiy (Designing industrial enterprises) Moskva, Gos. Izd-vo Literatury po Stroitel'stvu i Arkhitekture, 1952.
198 p. illus., diagrs., tables.
At head of title: M. L. Zaslav, V. N. Zlatolinskiy, A. E. Levinson, T. G. Petrova, G. N. Ufimtsev, P. M. Frenkel.

UFIMTSEV, G.N.

POLYAKOV, D.L., inzhener, redaktor; BATURIN, V.V., kandidat tekhnicheskikh nauk, redaktor; BORISOV, V.P., inzhener, redaktor; GOVOROV, V.P., inzhener, redaktor; MATS, Ya.M., inzhener, redaktor; RYVKIN, Kh.I., kandidat tekhnicheskikh nauk, redaktor; TURKUS, V.A., dotsent, redaktor; KORSAKOV, S.S., retsenzent; UFIMTSEV, G.N., retsenzent.

[Manual for planning heating and ventilation systems of industrial enterprises] Spravochnik po proektirovaniiu otopleniia i ventiliatsii promyshlennykh predpriiatii. [Redkollegiia D.L. Poliakov i dr. Redaktor V.A. Turkus] Moskva, Gos. izd-vo lit-ry po stroitel'stvu i arkhitekture, 1953- (MIRA 7:6)

1. Leningrad. Proyektnyy institut ministerstva stroitel'stva. (Heating--Handbooks, manuals, etc.) (Ventilation--Handbooks, manuals, etc.)

KISSIN, Mikhail Isakovich, dotsent, kandidat tekhnicheskikh nauk,[deceased]; MAZO,A.V., inzhener, retsenzent; UL'YANINSKIY,S.V., professor, doktor tekhnicheskikh nauk, retsenzent; UFIMTSEV,G.N., inzhener, retsenzent, redaktor; GOLUBENKOVA,L.A., redaktor; MEDVEDEV,L.Ya., tekhnicheskiy redaktor

[Heating and ventilating] Otoplenie i ventiliatsiia. Izd.2-oe, perer. Moskva, Gos.izd-vo lit-ry po stroitel'stvu i arkhitekture. Pr.1. [Heating] Otoplenie. 1955. 390 p. (MIRA 9:3)

(Heat engineering)

KYUBLER, O.A., inzh., red.; UFIMTSEV, G.N., inzh., red.; GRIGOR'YEV, P.G., red.; TOL', A.O., red.; MUNITS, A.P., red.izd-va; BOROVNEV, N.K., tekhn.red.; SOLNTSEVA, L.M., tekhn.red.

[Unified standards for planning and survey work paid by a piece-rate] Edinye normy vyrabotki na proektnye i izyskatel'skie raboty, oplachivaemye sdel'no. Moskva, Gos.izd-vo lit-ry po stroit., arkhit. i stroit.materialam. Pt.2. [Industrial buildings and structures] Promyshlennye zdaniia i sooruzheniia. 1958. 86 p. Pt.4. [Interior sanitary-engineering installations for buildings and structures] Vnutrennie sanitarno-tekhnicheskie ustroistva zdanii i sooruzhenii. 1958. 50 p. Pt.5. [Making estimates] Smetnye raboty. Pt.6. [Blueprinting] Kopiroval'nye raboty. 1958. 44 p. (MIRA 12:12)

1. Russia (1923- U.S.S.R.) Gosudarstvennyy komitet po delam stroitel'stva.

(Building--Production standards)

BELOUSOV, Vladimir Vladimirovich, inzh.; MIKHAYLOV, Fedor Semenovich, inzh.; SMIRNOV, L.I., inzh., nauchnyy red.; UFIMTSEV, G.N., inzh., red.; SAFONOV, P.V., red. izd-va; RODIONOVA, V.M., tekhn. red.

[Principles of the design of central heating systems] Osnovy proektirovaniia sistem tsentral'nogo otopleniia. Moskva, Gosstroiizdat, 1962. 401 p. (MIRA 15:12)

(Heating)

KISELEV, G., mayor; TOPIL'SKIY, V., mayor; GLUSHKIN, I., starshina; UFIMTSEV, I., kapitan; PROKOP'YEV, G., starshiy leytenant; DEREVYANKO, N., leytenant

How do you train radiotelegraph operators?; discussion of the article published in No.1. Voen. vest. no.3: 101-103 Mr'64.

(MIRA 17:5)

SUD-ZLOCHEVSKIY, A.I. [Sud-Zlochevs'kyi, A.I.] (Kiyev);
UFIMTSEV, I.G. [Ufimtsev, I.H.] (Kiyev)

Method for optimizing a transient process in a servosystem with an oscillatory drive of the third order. Avtomatyka 8 no.6:3-10 '63. (MIRA 17:8)

POLESHCHUK, V.Ye., kand. istoricheskikh nauk, dotsent, mayor; KUSHNEROV, P.I., podpolkovnik; YAKOVLEV, V.N., kapitan 2-go ranga; DMITRIYEV, V.A., kapitan 3-go ranga; UFIMTSEV, L.Ya., red.; MIRKISHIYEVA, S., tekhn.red.

[The fighting and revolutionary traditions of the sailors of the Red Banner Caspian Fleet] Boevye i revoliutsionnye traditsii moriakov Krasnoznamennoi Kaspiiskoi flotilii. Baku, Azerbaidzhanskoe gos. izd-vo, 1960. 178 p. (MIRA 14:5)
(Russia--Navy)

UFIMTSEV, N.I.; TRENIKHIN, O.K.

At the electrified a.c. sections of the Krasnoyarsk railroad. Elek. i tepl. tiaga 5 no.3:28-29 Mr '61. (MIRA 14:6)

1. Nachal'nik distantsii kontaktnoy seti st. Bazaikha (for Ufimtsev).
2. Nachal'nik Krasnoyarskogo uchastka energosnabzheniya (for Trenikhin).

(Electric railroads)

UFIMTSEV, N.I., inzh.

Some methods of work on the a.c. overhead contact system.
Elek.i tepl.tiaga 6 no.4:10-11 Ap '62. (MIRA 15:5)
(Electric railroads--Maintenance and repair)

UFIMTSEV, P., inzhener.

Motortrucks at the 3rd International Fair in Damascus. Avt.transp. 35 no.6:37 Je '57. (MIRA 10:7)

(Damascus--Fairs--Motortrucks)

UFIMTSEV, P. YA.

AUTHOR: Ufimtsev, P. Ya.

57-8-27/36

TITLE: An Approximative Calculation of Diffraction of Plane Electro-magnetic Waves on Some Metallic Bodies. I. Wedge and Band Diffraction (Priblizhennyy raschet diffraktsii ploskikh elektro-magnitnykh voln na nekotorykh metallicheskikh telakh. I Diffraktsiya na kline i lente)

PERIODICAL: Zhurnal Tekhn.Fiz. 1957, Vol 27, Nr 8, pp 1840-1849 (USSR)

ABSTRACT: Approximate methods are of great importance as the exact solutions of the diffraction problems for complicated bodies meet with great mathematical difficulties. The author starts from the idea that a field diverged by the body can be taken as a sum of two current components flowing on the surface. The one component is the uniform one which obeys to the laws of geometrical optics, the field of which can be found by means of quadratures, and which represents the so-called Kirchhoff approach. The nonuniform component is that current which is added to the uniform one in connection with the surface curvature. In the case of convex bodies the non-uniform component can be assumed on a sufficiently small element of the convex surface in the neighborhood of the break and approximately equal to that of the corresponding dihedral angle (wedge). The diffraction is investigated with a wedge and a band, either of them perfectly conductive, and an approximate calculation of them is carried out. The method given here can also be

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An Approximative Calculation of Diffraction of Plane Electro- 57-8-27/36
magnetic Waves on Some Metallic Bodies. I. Wedge and Band
Diffraction.

used for wave lengths which are by far smaller than the
measurements of linear bodies, and this also in the case of a
sufficiently great distance from the bodies. There are 9 figures
and 2 Slavic references.

SUBMITTED: July 30, 1956
AVAILABLE: Library of Congress

Card 2/2

AUTHOR: Ufimtsev, P. Ya. 57-28-3-21/33

TITLE: Secondary Diffraction of Electromagnetic Waves on a Band (Vtorichnaya diffraktsiya elektromagnitnykh voln na lente)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 3, pp. 569-582 (USSR)

ABSTRACT: The approximation method for solving the diffraction problems earlier developed in references 1 and 2 is precisely defined here. The so-called effect of the secondary diffraction, i. e. the interaction of currents flowing in the different elements of the body surface is taken into account here. The dispersing object can be approximated by a number of sources - luminous lines and points. The problem posed here consists in the finding of those functions which determine the continuous modifications of the field of each of those sources on transition through the corresponding light-shadow-boundary. This problem is here investigated in application to the simplest body - a band - and more accurate formulae for the dispersing field are obtained. In the case of the diffraction on a band the part

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Secondary Diffraction of Electromagnetic Waves on a Band 57-28-3-21/33

played by the above-mentioned interaction is most essential in the direction of observation near the band-plane as well as in the case of grating incidence of the irradiating wave. Approximation formulae for the field dispersed by the band are derived which are useful for any directions of radiation and observation. Computations of the disperion characteristics according to the exact and the approximation theory are performed and then a comparison of the two is given. The results show a satisfactory agreement between the approximation method and the exact theory already at $ka = \sqrt{28}$, although in this case only about two and a half wave lengths come to lie on the width of band. The work was guided by L. A. Vaynshteyn.

There are 13 figures, and 4 references, 3 of which are Soviet.

SUBMITTED: March 25, 1957.

: 1. Electromagnetic waves--Diffraction 2. Electromagnetic waves --Electrical factors 3. Mathematics

Card 2/2

UFIMTSEV, P.Ya.

Approximate calculation of the diffraction of plane electromagnetic waves on some metallic surfaces. Part 2: Diffraction on a disk and a finite cylinder. Zhur. tekh. fiz. 28 no.11:2604-2616 N '58.
(MIRA 12:1)

(Electric waves--Diffraction)

AUTHOR: Ufimtsev, P. Ya. 57-28-3-22/33

TITLE: Secondary Diffraction of Electromagnetic Waves on a Disk (Vtorichnaya diffraktsiya elektromagnitnykh voln na diske)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 3, pp. 583-591 (USSR)

ABSTRACT: The approximate solution of the diffraction problem for a disk found earlier (reference 1) is precisely defined here. The interaction of the boundary currents is approximately taken into account here. Equations for the field dispersed by the disk are derived. The dispersion characteristics are computed and compared with the results of the exact theory and those of the experiment. A satisfactory agreement with the experiment is determined. The taking into account of the interaction of the boundary currents precisely defines the approximation given earlier and is in better agreement with the exact theory.
The work was guided by L. A. Vaynshteyn.
There are 6 figures, and 3 Soviet references.

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Secondary Diffraction of Electromagnetic Waves on a Disk 57-28-3-22/33

SUBMITTED: March 25, 1957.

[illegible]: 1. Electromagnetic waves--Diffraction 2. Mathematics

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20410

9,9300

S/109/60/005/012/008/035
E032/E514

AUTHORS: Mayzel's, Ye. N. and Ufimtsev, P. Ya.

TITLE: Reflection of Circularly Polarized Electromagnetic Waves from Metal Bodies

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol.5, No.12, pp.1925-1928

TEXT: The Kirchhoff method is frequently used to treat the reflection of electromagnetic waves by metal bodies. According to this method the scattered field is produced by a surface current given by

$$\vec{j} = \frac{c}{2\pi} \left[\vec{n}\vec{H} \right], \quad (1)$$

where c is the velocity of light in vacuo, $\vec{n}$ is the outward normal to the surface of the body and $\vec{H}$ is the magnetic field of the incident wave. Physically Eq.(1) means that at each element of area on the "illuminated" surface the current is considered to be the same as at an infinite, perfectly conducting plane tangent to the given element. However, this formula does not take into account additional currents due to the curvature of the surface. Any real surface current must be looked upon as a sum of the "uniform"

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Reflection of Circularly Polarized Electromagnetic Waves from Metal Bodies

current component given by Eq.(1) and a "nonuniform" component due to the curvature. The Kirchhoff approximation must, therefore, be abandoned whenever the nonuniform component is of interest. The second of the present authors has developed methods which could be used in this connection. In many cases, however, a direct calculation is difficult and it is, therefore, desirable to develop a method which could be used to measure the nonuniform component of the scattered field directly. It is shown in the present paper that such measurements can be carried out for rigid bodies of revolution with the aid of circularly polarized electromagnetic waves. It is shown that when such bodies are irradiated with circularly polarized electromagnetic waves, the nonuniform components in the scattered field can be separated out with the aid of a polarizer. Numerical calculations have been carried out for a flat disc having a diameter of the order of the wavelength. The numerical calculations (Fig.3) were found to be in good agreement with experimental results. The discrepancy between the two curves is partly due to the fact that

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E032/E514

Reflection of Circularly Polarized Electromagnetic Waves from Metal Bodies

in the experimental part a truncated conical specimen instead of a disc was employed. There are 3 figures and 3 Soviet references.

SUBMITTED: March 26, 1960

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22893

9,3700 (1057,1163,1482)

S/109/61/006/004/007/025
E032/E135

AUTHOR: Ufimtsev, P.Ya.

TITLE: Symmetrical Irradiation of finite bodies of revolution

PERIODICAL: Radiotekhnika i elektronika, Vol.6, No.4, 1961, pp. 559-567

TEXT: The diffraction of electromagnetic waves by perfectly-conducting finite bodies with surface discontinuitite is of considerable interest but, in view of its complexity, has not so far been fully investigated. In the case of radio waves whose wavelength is short in comparison with the linear dimensions of the diffracting object, it is usual to employ the Kirchhoff approximation. It is stated that this approximation frequently leads to incorrect results and should be improved. In the special case of convex solids of revolution irradiated along the axis of symmetry, the present author has found an improved approximation for the effective surface (Ref.1: ZhTF, 1957, 27, 8, 1840, and Ref.2: ZhTF, 1958, 28, 11. 2604). The method employed in the calculation has been described in the mentioned papers. The scattered field is determined as a sum of "uniform" and

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S/109/61/006/004/007/025
E032/E135

Symmetrical irradiation of finite bodies of revolution

"nonuniform" components. The uniform component represents the scattered field on the Kirchhoff approximation and is found to be integrating the surface current

$$\vec{j} = \frac{c}{2\pi}\left[\vec{n}\vec{H}\right]$$

where: c is the velocity of light in vacuum; $\vec{n}$ is the output normal to the surface; and $\vec{H}$ is the magnetic field of the incident wave. The nonuniform component is an additional field due to the discontinuity and must be taken into account if one is to obtain correct results. The theory developed in Refs.1 and 2 is now extended to the case of a cone and a paraboloid of revolution ($r^2 = 2pz$). The author calculates the effective scattering surface of a finite cone and a paraboloid of revolution. The linear dimensions of the bodies are assumed large in comparison with the wavelength, with ideally conducting surfaces. Irradiation is carried out parallel to the axis of symmetry. The author finds that the shape of the body in the shadow region influences the reflected signal to a distance of several

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S/109/61/006/004/007/025
E032/E135

Symmetrical irradiation of finite bodies of revolution

wavelengths from the edge of the shadow. While the expressions found are in good agreement with experimental results, even for large dimensions, they do not pass into the formulae of physical optics. At the same time they differ from the results of the Kirchhoff approximation, which does not agree too closely with experiment. Thus, for example, Fig.4 shows a plot of log σ (σ is the effective scattering area) as a function of the length of the cone. The points are experimental and the dashed curve represents the Kirchhoff approximation and the full curve the present results. Acknowledgements are expressed to Ye.N. Mayzel's and L.S. Chugunova for their assistance.
There are 10 figures and 5 references: 2 Soviet and 3 non-Soviet.

SUBMITTED: April 28, 1960

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30443
S/109/61/006/012/018/020
D201/D305

9,1912

AUTHOR: Ufimtsev, P.Ya.

TITLE: Reflection of circularly polarized radiowaves from metal bodies

PERIODICAL: Radiotekhnika i elktronika, v. 6, no. 12, 1961, 2094 - 2095

TEXT: E.N. Mayzel's and P.Ya. Ufimtsev, suggested (Ref. 1: Radiotekhnika i elektronika, 1960, 5, 12, 1925) a method for measuring the 'irregular' component of the field dispersed by metal bodies of revolution. In the present short communication it is shown that this method may be applied for measuring the irregular field component of the field, dispersed by metal objects of finite dimensions of any shape. The system of coordinates is chosen so that the normal $\vec{N}$ to the incident wave front, drawn through the origin be in plane yoz as shown in Fig. 1. It is easy to show that with E-polarization ($\vec{E}_0 \perp$ yoz) the current density induced at the body surface by the incident wave is given in the Kirchhoff approximation

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Reflection of circularly polarized ...

by

$$i_x = -\frac{c}{2\pi} E_{0x} (n_y \sin\gamma + n_z \cos\gamma) e^{i\Psi},$$
$$i_y = \frac{c}{2\pi} E_{0x} n_x \sin\gamma e^{i\Psi}, \quad (1)$$
$$i_z = \frac{c}{2\pi} E_{0x} n_x \cos\gamma e^{i\Psi},$$

$$i_x = 0,$$
$$i_y = \frac{c}{2\pi} H_{0x} n_z e^{i\Psi}, \quad (2)$$
$$i_z = -\frac{c}{2\pi} H_{0x} n_y e^{i\Psi},$$

for an H-polarized wave ($\vec{H}_0 \perp yoz$) where C - velocity of light in vacuum; E_{ox} and H_{ox} - amplitudes of the el. and magn. components of the incident wave for E and H polarization respectively; $\Psi = K(y' \sin\gamma + z' \cos\gamma)$ - the phase of the incident wave at point (x', y' z') at body surface; n_x, n_y, n_z - components of the normal to the surface at the same point. The time dependence is assumed to be $e^{-i\omega t}$. In radio telemetry, when the direction of observation and

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transmission usually coincide, (the spherical coordinates of the point of observation being R, ϑ, φ) so that $\vartheta = \pi - \gamma$, $\varphi = -\pi/2$, expressions

$$E_x = -H_\theta = \frac{iaE_{0x}}{2} \overline{\Sigma}_k \frac{e^{ikR}}{R}, \quad E_\theta = H_x = 0 \qquad (3a)$$

$$H_x = E_\theta = \frac{iaH_{0x}}{2} \Sigma_k \frac{e^{ikR}}{R}, \quad E_x = H_\theta = 0. \qquad (4a)$$

hold. The factor a in these expressions represents an arbitrary linear dimension of the body, and functions Σ_k and $\overline{\Sigma}_k$ are determined by

$$\Sigma_k = -\overline{\Sigma}_k = \frac{k}{\pi a} \int (n_y \sin\gamma + n_z \cos\gamma) e^{i\Phi} dS. \qquad (5)$$

Thus the equality $\Sigma_k = -\overline{\Sigma}_k$ is satisfied for any body shape and the method described in (Ref. 1: Op.cit.) has a general meaning and permits isolation from the field, dispersed by a metal body. There are 1 figure and 1 Soviet-bloc reference.

SUBMITTED: June 10, 1961

UFIMTSEV, Petr Yakovlevich; IVANUSHKO, N.D., red.; SVESHNIKOV, A.A., tekhn. red.

[Edge wave method in physical diffraction theory] Metod kraevykh voln v fizicheskoi teorii difraktsii. S predisl. L.A. Vainshteina. Moskva, Sovetskoe radio, 1962. 242 p. (MIRA 16:4)

(Diffraction)

34491
S/109/62/007/002/010/024
D266/D303

9,9300

AUTHOR: Ufimtsev, P.Ya.

TITLE: Scattering of a plane electromagnetic wave by a thin cylindrical conductor

PERIODICAL: Radiotekhnika i elektronika, v. 7, no. 2, 1962, 260 - 269

TEXT: The purpose of the paper is to study the scattering effect of a cylindrical conductor of radius α and length L. The direction of the incident plane electromagnetic wave is given by the angle ϑ_0 the polarization of the wave by α, ($\alpha = 0$ if the electric vector lies in the plane of the paper), the direction of observation by ϑ. The author's calculations are based on the following physical picture: The incident plane wave excites certain waves (called "edge" waves) which are scattered on the opposite end of the conductor and cause the excitation of secondary "edge" waves. These secondary waves excite ternary waves, etc. The first order term is given by the expression

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Scattering of a plane electromagnetic..

$$E_{\vartheta}^{(1)} = H_{\varphi}^{(1)} = - E \frac{e^{ikR}}{kR} F^{(1)}(\vartheta_0, \vartheta), \qquad (3)$$

where R - distance of the point of observation, $k = 2\pi/\lambda$, λ - wavelength and $F^{(1)}(\vartheta_0, \vartheta)$ can be determined by employing L.A. Vaynshteyn's variational principle (Ref. 4: ZhTF, 1961, 31, 1, 29). Summing all the contributions up to infinity the resultant field strength in the far field is obtained. The resulting formula is lengthy and complicated, but two important conclusions can be immediately drawn: 1) If $L = n(\lambda/2)$ resonance occurs; 2) The formula is invariant in respect of a change of ϑ and ϑ_0. This last property follows from the reciprocity theorem. The author claims that in previous treatments - due to different approximations - reciprocity was not satisfied and his is the first solution which comes to the correct result. There are 4 figures and 7 references: 5 Soviet-bloc and 2 non-Soviet-bloc. The references to the English-language publications read as follows: K. Lindroth, Trans. Roy. Inst. of Technol., Stockholm, 1955, no. 91; J.H. Van Vleck, F. Bloch, M. Hamermesh, J. Appl. Phys., 1947, 18, 3, 274.

SUBMITTED: June 10, 1961

Card 2/2

UFIMTSEV, P.Ya.

Transverse diffusion during diffraction on a wedge. Radiotekh. i elektron. 10 no.6:1013-1022 Je '65. (MIRA 18:6)

L 22931-66 EWT(m)/EWP(t) IJP(c) JD/JG

ACC NR: AP6013343 SOURCE CODE: UR/0363/66/002/004/0657/0658

AUTHOR: Fistul', V. I.; Omel'yanovskiy, E. M.; Pelevin, O. V.; Ufimtsev, V. B. 51

ORG: Giredmet

B

TITLE: The effect of the nature of dopant on electron scattering and polytropy of dopant in n-type gallium arsenide

SOURCE: AN SSSR. Izvestiya. Neorganicheskiye materialy, v. 2, no. 4, 1966, 657-658

TOPIC TAGS: gallium arsenide, single crystal, semiconductor single crystal, activated crystal, donor impurity, electron mobility, carrier scattering, Hall mobility, impurity polytropy

ABSTRACT: The nature of the dopant was found to influence the electrical property of gallium arsenide single crystals doped with Te, Se, or S in widely varied concentrations in a manner analogous to that observed earlier in strongly doped semicondcutor Ge and Si. Single crystals were grown by an oriented crystallization technique under conditions which secured uniform distribution of impurity. Hall mobility at 300K was found to decrease in the sequence $u_{Te} > u_{Se} > u_S$ with increasing electron concentration in the sample. In agreement with theory this pattern of change in electron mobility reflected the effect of the nature of the dopant on scattering of electrons. Another effect of the nature of the dopant was detected in a study of the relation between electron concentration and atomic concentration of the dopant, as determined by

Card 1/2 UDC: 537.311.33:546.681'191

L 22931-66

ACC NR: AP6013343

chemical analysis. This effect was described as polytropy of impurity (dopant), i.e., the appearance of a part of impurity atoms in the crystal in a form, probably as a near order complex, deprived of the donor property. The polytropy was increasing in the sequence Te < Se < S at equal atomic concentration. Orig. art. has: 2 figures. [JK]

SUB CODE: 07/ SUBM DATE: 09Oct65/ ORIG REF: 002/ OTH REF: 004/ ATD PRESS: 4237

Card 2/2

UFIMTSEV, V. D., and KOZLOV, I. Ye.

"Characteriestics of the Heat Treatment of Cast Alloys to Be Used for Permanent Magnets." From the book, "Heat Treatment and Properties of Cast Steel." edited by N. S. Kreshchanovskiy, Mashgiz, Moscow 1955.

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ca

Electronic theory of the structure of aromatic compounds. V. N. Ufimtzev. *Anilinokrasochnaya Prom.* 4, 531-6(1934); cf. Berkenheim and Znamenskaya, *C. A.* 28, 5434⁴.—The theory of Berkenheim of the structure of aromatic sulfonic acids is contradicted by exptl. data. The basic error of the theory is that it is founded on the obsolete conception of the exclusive "electrovalent" character of the chem. bond, when it is materialized by way of the electrons migrating from one atom to another and the atoms acquiring elec. charges. Modern investigators, such as Lewis (Valence and Structure of Atoms and Molecules, *C. A.* 18, 490) and Langmuir, also consider other forms of chem. bond, when electrons do not migrate from one atom to another but form the "covalent bond." With this no ionization of the chem. compd. takes place; this is observed in most cases in the character of the bond in org. compds., and particularly in the bond of substituents with the aromatic nucleus. Chas. Blanc

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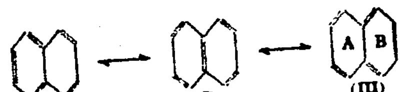
ca

Rules of substitution for the sulfonation of naphthalene and its derivatives. V. N. Ufimtsev. *J. Gen. Chem.* (U. S. S. R.) 5, 653 60(1935); cf. *C. A.* 28, 6433[6].—The rule of Armstrong and Wynne (*J. Chem. Soc.* 57, 130), limiting the possible orientations obtained in the sulfonation of $C_{10}H_8$ and derivs. has only 2 known exceptions, the sulfonation of 2,7-$C_{10}H_6(NH_2)SO_3H$ and 2,7-$C_{10}H_6$-(OH)SO_3H (*Ber.* 27, 1201, 1208). The rule of Vesely and Jakes (*C. A.* 18, 253), based largely on nitration expts., does not hold generally for sulfonation. The electronic theory of Berkengeim, *et al.* (*C. A.* 28, 3403[3]), postulating that entrance of SO_3H groups at certain positions in the nucleus will be immediately followed by rearrangement to more stable sulfite groups is shown to be untenable by a comparison of the sulfonation products with naphthyl sulfites. U. proposes a theory based on the tautomerism of $C_{10}H_8$. When $C_{10}H_8$ is sulfonated the equil. is displaced toward II (or III), the 1st group entering the cyclohexadiene ring A. Subsequently entering groups go preferentially to the aromatic ring B, thus accounting for the anomalous non-formation of 1,3-$C_{10}H_6(SO_3H)_2$ by direct sulfonation. The differences between rings A and B are also evident during hydrogenation, B being much



(II) (I) (III)

more resistant than A. Formulas II and III can be considered as consisting of a PhH nucleus with a 4-C side chain. It has been shown that *m*-directing groups in the side chains of PhH derivs. exert the same influence as if present in the ring though to a less degree, the extent depending upon the remoteness of the directing group from the ring (*C. A.* 21, 73, 2255). α-$C_{10}H_7SO_3H$ will sulfonate to give 1,5- and 1,7-derivs. β-$C_{10}H_7SO_3H$ will have a similar though less pronounced tendency. The 1,3- and 2,4-derivs. will be formed in lesser amt. If the 1st substituent is *p*- and *o*-directing α-compds. will substitute at 2 and 4 preferentially and at 6 and 8 to a less extent; β-compds. will substitute equally well at 1, 3, 6 or 8. The theory is confirmed by the yield of isomers obtained by the sulfonation of α-$C_{10}H_7SO_3H$, β-$C_{10}H_7SO_3H$, α- and β-$C_{10}H_7OH$, and α- and β-$C_{10}H_7NH_2$. Orientation in the $C_{10}H_8$ ring therefore is the same as in the PhH ring.

Lewis W. Butz

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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Sulfonation of naphthalene. A. N. [illegible] and A. F. Krivoshlykova. Org. Chem. Ind. (U. S. S. R.) 8, 144-51 (1939); cf. C. A. 28, 6433[9].—The methods of production of 1,3,6-$C_{10}H_5(SO_3H)_3$ and control by nitrating and reducing to the 1-NH_2 deriv. are discussed. It is claimed that 1,3,6-$C_{10}H_5(SO_2Cl)_3$ m. 197.8-8° and not at 190-1° as given in literature. Twenty references. C. B.

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ca

1,3,6-Naphthalenetrisulfonic acid. V. N. Udintsev. Russ. 50,089, March 31, 1937. Naphthalene is sulfonated in the usual manner to β-naphthalenesulfonic acid; this is cooled and (or) dild. with $H_2SO_4 \cdot H_2O$, oleum is added in amt. less than 3 mols. of free SO_3 per mol. of naphthalene, the mixt. is heated to 150-170°, the mass again cooled and the remaining required amt. of oleum added and the sulfonation is then carried out in the usual manner at 150-170°.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

BC

A-3

Structure of organic compounds. V. N. Ufimtsev (J. Gen. Chem. Russ., 1937, 7, 1874—1877).—Polemical against Dubroval (cf. A., 1937, I, 348).
R. T.

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PROCESSES AND PROPERTIES INDEX

The structure and reactivity of the naphthalene ring. II. Oxidation-reduction reactions and substitution in naphthalene derivatives. V. N. Ufimtsev. *J. Gen. Chem.* (U.S.S.R.) 7, 2402-5(1937); cf. *C. A.* 31, 102[9]. Reply to Ioffe (*C. A.* 31, 6224[1]). H. M. Leicester

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

CA

23

Preparation of the stable diazonium compound of Variamine Blue B. V. N. Ufimtsev, B. I. Gusman and A. V. Skorodumova. *Org. Chem. Ind.* (U. S. S. R.) 5, 325-7 (1938).—$(MeOC_6H_4NHC_6H_4N_2Cl)_2.ZnCl_2$ is best prepd. by diazotizing Variamine Blue B at 45-50° with the theoretical amt. of $NaNO_2$ and, after the addn. of $ZnCl_2$, pptg. with NaCl. The dye is stable on drying at 65-70°. It is decomposed at 110° and on exposure to daylight.
Chas. Blanc

Economy of raw materials in the production of intermediate products of dye industry. V. N. Ufimtsev. *Org. Chem. Ind.* (U. S. S. R.) 5, 446-53(1938). Improved procedures for the production of dye intermediate products are reviewed. Twenty references.
Chas. Blanc

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

Ca 25

Investigations in the field of azo dyestuffs. I. Sulfonation of hydrazobenzene. V. N. Ufimtsev. *J. Gen. Chem.* (U. S. S. R.) 10, 1757-60(1940).—Special methods must be used for prepn. of *N*-sulfohydrazobenzene. In Baumgarten's procedure (*C. A.* 21, 94) slow addn. of 32.8 ml. of $ClSO_3H$ to 164 ml. pyridine at 15-25°, rapid addn. of 16.4 g. hydrazobenzene at 15° and standing at 15° for 6 hrs., and treatment with 800 ml H_2O yields the pyridine salt of *N-sulfohydrazobenzene*. This is converted into the K salt by soln. in KOH, salting out with KCl and washing with KCNS soln. and EtOH. Free acid could not be isolated owing to rearrangement to a benzidine deriv. Other salts prepd. were: NH_4, Na, Ca, Ba, Ag, Cu, Ag-NH_4; prepd. but not isolated due to great H_2O soly.: Mg, Zn, Ni, Fe^{II}, Al, Pb, Sn, Cd. G. M. K.

Sci. Res. Inst. Organic Dyes + Intermediate Products im. Voroshilov

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The theory of color. I. Enoid systems without auxo-groups. V. N. Ufimtsev. *J. Gen. Chem.* (U. S. S. R.) 11, 814-6(1941).—U. investigated the problem of the nature of the action of so-called auxochrome groups, particularly in the cases of benzanilide-type compds. which contain a NO_2 and an auxochrome group in the *p,p'* positions; he believed in a similarity between such substances and the complex compds. of nitro compds. Thus, benzanilide, *p*-$H_2NHC_6H_4OH$ and *p*-$O_2NC_6H_4CONHPh$ are colorless; the first 2 due to the lack of a chromophore, the latter because complexes of nitro compds. with benzene are usually colorless. If, however, acenaphthene or fluorene is used instead of the Ph nucleus, intense color is observed in absence of the usual, so-called auxochromes. 5-Aminoacenaphthene (3.38 g.), 3.71 g. *p*-$O_2NC_6H_4COCl$ and 25 cc. pyridine were heated to 90° for 15 min., the mass was dild. by 50 cc. H_2O, the ppt. was repptd. from pyridine and recrystd. from EtOH, yielding 2.70 g. 5-(*p*-*nitrobenzoylamino*)*acenaphthene* (I), m. 198.7-200.5°. 2-Aminofluorene (3.63 g.), 3.71 g. *p*-$O_2NC_6H_4COCl$ and 25 cc. pyridine were heated to boiling, filtered and dild. with 100 cc. EtOH, yielding 3.50 g. 2-(*p*-*nitrobenzoylamino*)*fluorene* (II), m. 285.2-5.8° (from EtOH). 5-Aminoacenaphthene (2.9 g.), 3 g. *p*-$O_2NC_6H_4CH_2Cl$ and 10 cc. pyridine were refluxed for 10 min., and the soln. dild. with 15 cc. EtOH, yielding 1.02 g. 5-(*p*-*nitrobenzylamino*)-*acenaphthene* (III), m. 196-7.2° (from benzene). 2-Aminofluorene (2.8 g.), 2.65 g. *p*-$O_2NC_6H_4CH_2Cl$ and 10 cc. pyridine were refluxed for 10 min., the soln. dild. with 50 cc. EtOH, yielding 1.28 g. 2-(*p*-*nitrobenzylamino*)-*fluorene* (IV), m. 141.8-3.2° (from EtOH). I and II were intensely yellow, while III and IV were intensely brick-red. The color is apparently due to the interaction of the nitro group with unsatd. nuclei of acenaphthene and fluorene.

G. M. Kosolapoff

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Investigations in the field of azo dyestuffs. II. Soluble forms of insoluble azo dyes. V. N. Ufimtsev. *J. Applied Chem.* (U. S. S. R.) 14, 600-11(1941); cf. C. A. 35, 3810[6]. —Formation of fairly easily decomposed sol. derivs. of insol. dyes, suitable for practical application, was studied, particularly the pyridinium salts of complex esters of β-naphthol-type azo dyes. 1-Phenylazo-2-naphthol (5.04 g.), heated to boiling with 0.5 cc. $ClCH_2COCl$ for 15 min., dild. with a little AcOH and cooled, yielded 2.9 g. 1-phenylazo-2-naphthyl chloroacetate, m. 115-17° (after crystn. from AcOH, m. 127.5-8°). Two g. of this acetate in 40 cc. C_5H_5N deposited on standing for several hrs. a cryst. pyridinium chloride, insol. in toluene and Et_2O, easily sol. in H_2O acidified with AcOH, and in AcOH. 1-(1'-Naphthylazo)-2-naphthol (23.5 g.) in 50 cc. toluene treated with 12.5 cc. $ClCH_2COCl$ and boiled for 2 hrs. (until HCl evolution ceased), deposited on cooling the chloroacetate, m. 140-40.5° (from toluene); 3.84 g. of this ester in 20 cc. toluene at 60° was treated with 4 cc. C_5H_5N and kept at 50-60° for 0.5 hr.; on cooling, the pyridinium salt was filtered, washed with toluene and Et_2O and dried; yield 1.08 g.; its soly. is similar to that of the Ph compd. 1-(4'-Nitrophenylazo)-2-naphthol (29.3 g.) in 250 cc. toluene, treated with 15.5 cc. $ClCH_2COCl$ and boiled for 2 hrs. (until HCl evolution ceased), filtered hot, and the filtrate cooled, gave 8.08 g. of the chloroacetate after recrystn. from toluene, m. 183.5-4°. This ester hydrolyzed easily on crystn. from AcOH as well as during attempts to prep. its pyridinium salt. 1-Phenylazo-2-naphthol (4.96 g.), 2.46 g. nicotinic acid, 5 cc. thionyl chloride and 10 cc. toluene were heated to boiling for 1 hr. (until HCl evolution ceased); the ppt. of 1-phenylazo-2-naphthyl nicotinate (4.88 g.), m. 113-17°, was filtered. from MeOH, m. 122.5-3.5°; 2.05 g. of this ester in 10 cc. toluene treated with 1 cc. MeI gave after 10 days at 15° 1-phenylazo-2-naphthyl nicotinate methiodide, sol. in H_2O, EtOH, AcOH and C_5H_5N, insol. in toluene and benzene. All of these quaternary N salts when treated in aq. soln. with NaOH, or even NH_4OH, hydrolyze rapidly with regeneration of the original dye, the ester grouping also being ruptured. The pyridinium salt decomposes even on prolonged standing in H_2O soln., and rapidly on heating. Development of these salts on fabrics by treatment with alkali leads to the same result. G. M. Kosolapoff

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Regularities in the melting and boiling points of cyclic compounds. V. N. Ufimtsev. *J. Gen. Chem.* (U.S.S.R.) 13, 516-19(1943)(English summary).—Extensive exptl. material available is in direct contradiction to the theory expressed by Nikol'skii (*C. A.* 36, 5635[4]). G. M. K.

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3RD AND 4TH ORDERS

Bisulfite compounds. I. Spectra of bisulfite com-
pounds of azo dyes. V. N. Ufimtsev and E. S. Levin.
J. Applied Chem. (U. S. S. R.) 16, No. 9/10, 306-8
(1943)(English summary).—Spectrophotometric measure-
ments were made on bisulfite compds. of simple dyes made
from 4-benzeneazo-1-naphthol and 1-benzeneazo-2-naph-
thol. The spectra of these products differ from the spectra
of enol forms and hydrazone forms of other characteristic
compds. of these dyes. The existence of color in these bi-
sulfite compds. and the ease of their hydrolysis in alkali
are contrary to the structure proposed by Spiegel (Ber.
18, 1479(1885)). Spectrum curves of the compds. are
presented. G. M. Kosolapoff

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Bisulfite compounds. II. Bisulfite compound of 1-phenylazo-2-naphthol and its structure. V. N. Ufimtsev. *J. Applied Chem.* (U. S. S. R.) 16, No. 9/10, 360-76 (1943)(English summary); cf. *C. A.* 38, 6203[1].—Salts of 1-phenylhydrazono-2-hydroxy-1,2-dihydro-2-naphthalenesulfonic acid (I) (bisulfite compd. of 1-phenylazo-2-naphthol (II)) were prepd. as follows: 10 g. of Na salt treated with NH_4Cl soln. at 70° (20 g. NH_4Cl) gave 3.58 g. *NH_4 salt* as yellow-orange needles; *Ag salt*, from the Na salt with $AgNO_3$, orange to reddish prisms; *Pb salt*, from $Pb(OAc)_2$, yellow needles; *Ba salt*, from $BaCl_2$, yellow tablets; *aniline salt*, from $PhNH_3Cl$, yellow needles; *1-naphthylamine salt*, difficultly sol. yellow prisms; *2-naphthylamine salt*, yellow rhomboids; *phenylhydrazine salt*, orange-yellow needles. *Free acid*, from the NH_4 salt by HCl in the cold, orange-yellow needles. *Me ester*, from the Ag salt and MeI, m. 127-8° (from benzene). Reduction of the Na salt by $SnCl_2$ gave 1-phenylazo-2-naphthol and 1-amino-2-naphthol-4-sulfonic acid. Reduction of the K salt of 1-(*p*-sulfophenylhydrazono)-2-hydroxy-1,2-dihydro-2-naphthalenesulfonic acid by Zn-HCl gave 72% of 1-amino-2-naphthol; no 1-amino-2-naphthol-4-sulfonic acid was isolated. The properties of the bisulfite compd. of II show it to be I.

G. M. Kosolapoff

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On the structure and the properties of 2-naphthol azo dyes. V. N. Ufimtsev. *Compt. rend. acad. sci. U. R. S. S.* 39, 351-3(1943)(in English); cf. *C. A.* 37, 4783[9]; 39, 3658[9]. —Evidence is presented supporting the chelate theory of the structure of those azo dyes which contain an OH group ortho to the azo group. Tabulated data establish the tendency toward higher m. ps. of such dyes as compared (1) with their derivs. in which the OH group is esterified or etherified and (2) with their isomers having the OH group para to the azo group. The insoly. of certain dyes, e. g., 1-phenylazo-2-naphthol, in alkalies may be due to their very limited soly. in water. The shift in the max. of the absorption spectra, caused by the OH group of sulfonated azo dyes entering into salt formation with NaOH or NaOEt, had a different character depending on whether the OH group was ortho or para to the azo group.

J. W. Perry

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Bisulfite compounds. V. The structure of the bisul-fite compound of 2-methyl-1,4-naphthoquinone and of its 3-sulfonic acid (analogs of vitamin K). V. N. Ufimtsev. *J. Gen. Chem.* (U.S.S.R.) 14, 1063-9(1944).—Evidence is presented supporting the view that $KHSO_3$ (I) combines with 2-methyl-1,4-naphthoquinone (II) to form K 1-oxo-2-methyl-1,4-dihydro-4-naphthalenesulfonate (III) and with K 2-methyl-1,4-naphthoquinone-3-sulfonate (IV) to form K 1-oxo-2-methyl-1,4-dihydro-3,4-naphthalene-disulfonate (V). Very pure III was prepd. as follows. First, 20 g. II was dissolved at 40-50° in 80 cc. of a soln. of I of sp. gr. 1.24. The soln. was filtered at once and cooled. The cryst. ppt. was filtered off, washed with 20-cc. portions of water and of alc. and with 70 cc. ether, then twice recrystd. from water, and again washed with alc. and ether. Very pure V was prepd. by dissolving 4.84 g. of III in 12 cc. of a soln. of I of sp. gr. 1.24 and 7 cc. water, then adding 15 cc. water, heating, filtering, and purifying as when prepg. III. On treating with NH_4OH, caustic or alkali carbonates, III and V decomposed immediately. Aq. solns. of III were colorless and gave no ppt. with $BaCl_2$ or $AgNO_3$, or by treating with Cl in cold soln. However, in boiling soln., Cl oxidized III to K 2-methyl-1,4-naphthoquinone-3-sulfonate. On mixing aq. solns. of V and $BaCl_2$, a finely cryst. ppt. of the Ba salt (VI) corresponding to V gradually formed. On boiling with water, VI decompd. with pptn. of $BaSO_4$. Oxida-tion of V with H_2O_2 in dil. H_2SO_4 soln. did not result in formation of a "bisulfite complex" (cf. *C.A.* 38, 3325[4]) but caused complete oxidation of part of the V, with the rest recovered and identified as VI. $O_2NC_6H_4NHNH_2$ (0.76 g.) in 10 cc. HOAc and 0.86 g. II in 40 cc. HOAc were mixed and dild. with 40 cc. HOAc and 50 cc. water. After standing 40 hrs., dark red needles of 4-(*p*-nitro-phenylazo)-2-methyl-1-naphthol, m. 267-7.5° (decompn.) after recrystn. from alc., sepd. Similarly, II was reacted with $PhNHNH_2.HCl$ to form 4-phenylazo-2-methyl-1-naphthol, m. 207.7-8.0° after recrystn. from alc.

J. W. P.

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Bisulfite compounds. III. Structure of the bisulfite compound of 1-nitroso-2-naphthol. V. N. Ufimtsev. *J. Applied Chem.* (U. S. S. R.) 17, 159-64(1944)(English summary); cf. *C. A.* 39, 511[1].—The bisulfite compd. of 1-nitroso-2-naphthol (9.35 g.) in 60 cc. water and 25 cc. concd. HCl was treated with 6.8 g. Zn dust at 8-12°; the filtrate yielded 4.42 g. *1,2-dihydro-1-amino-2-naphthol-2-sulfonic acid* (I). I, shaken with 15% NaOH and BzCl, gave *dibenzoyl-1-amino-2-naphthol*, m. 233.5-4° (from AcOH). I, refluxed with 1:1 HCl, gave 92% *1-amino-2-naphthol.HCl*; the latter boiled with $NaHSO_3$ in dil. EtOH gave *1-amino-2-naphthol-4-sulfonic acid*. I, treated with a stream of air at room temp. in water, gave 1-amino-2-naphthol-4-sulfonic acid. Hence, the bisulfite compd. of 1-nitroso-2-naphthol has the structure of the Na salt of 1-isonitroso-1,2-dihydro-2-naphthol-2-sulfonic acid.

G. M. Kosolapoff

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

Ca

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Bisulfite compounds. IV. Structure of bisulfite compounds of naphtholsulfonic acids. V. N. Ufimtsev (Inst. State Com. Health, Moscow). *J. Applied Chem.* (U.S. S.R.) 17, 557 (4) 1944)(English summary); cf. C.A. 39, 1158'.--Bisulfite compds. prepd. according to the Bucherer method were made from 1-naphthylamine-4- and 5-sulfonic acids, in the form of K and amine salts. The products correspond to 1,2- or 1,4-dihydro-1-naphthol-1,4- and 1,5-disulfonic acids, with both sulfo groups being strongly acidic. The Reinking-Dehnel-Labhardt reaction (*Ber.* 38, 1069 (1905)) is not suitable for the prepns. since carefully purified products failed to give this reaction. 1-Naphthylamine-4-sulfonic acid (50 g.), 20 g. 80% KOH, and 200 cc. $NaHSO_3$ soln. (d. 1.32) were boiled for 8 hrs. and acidified to Congo red with 22 cc. concd. H_2SO_4. The *Na K salt of the bisulfite deriv.* sepd. on concn. *in vacuo* and addn. of EtOH, and was dried after washing with EtOH; yield 22.5 g.; it was almost completely free of Cl and SO_4; for purification it was converted to the naphthylamine or acriquine salt: 15 g. of the Na K salt in 70 cc. water with a few drops HCl was treated with $BaCl_2$ to ppt. SO_4; the clear filtrate was treated with 15 g. 2-$C_{10}H_7NH_2$ and 10 cc. concd. HCl in 100 cc. water; the square plates of the *naphthylamine salt* were filtered, washed with water, and pptd. from EtOH by Et_2O, followed by crystn. from EtOH and finally from water; on treatment with strong alkali it decomposes to yield the amine, alkali sulfite, and 1-naphthol-4-sulfonic acid; it does not lose wt. on heating over P_2O_5 and fails to give the Reinking-Dehnel-Labhardt reaction. The *acriquine salt* was formed analogously; it forms lancet type crystals, bright yellow, and is poorly sol. in water and EtOH. 1-Naphthylamine-5-sulfonic acid (50 g.) and 200 cc. $NaHSO_3$ soln. (d. 1.32) were boiled for 30 hrs., acidified to Congo red with 50% H_2SO_4, and treated with EtOH after concn. to sep. most of Na_2SO_4. When the filtrate was concd. to 1.5 cc. (?) and the mix treated with 30 g. KCl there was obtained 10.7 g. of the *di-K salt of the bisulfite compd.* On soln. of this in 150 cc. water with warming and standing for 24 hrs. in the cold there was obtained 3.12 g. *di-K salt of 1,1'-dinaphthylamine-5,5'-disulfonic acid*; the filtrate on evapn. and addn. of EtOH gave 20.6 g. of the *di-K salt of the bisulfite compd.*; it was sol. in water and EtOH, insol. in Et_2O, formed hexagonal plates, failed to lose wt. on heating over P_2O_5, and did not give the R.-D.-L. reaction; on treatment with strong alkali it gave the alkali sulfite and 1-naphthol-5-sulfonic acid. The K salt was converted into the *1-naphthylamine salt*, as above; this forms clusters of needles and is poorly sol. in cold water. G. M. Kosolapoff

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

Ca

10

Structure of the bisulfite compound of 2-methyl-1,4-naphthoquinone and of its 3-sulfonic acid (analogs of vitamin K). V. N. Ufimtsev. *Compt. rend. acad. sci. U.R.S.S.* 44, 325-7(1944).—The products are K 1-oxo-2-methyl-4-hydroxy-1,4-dihydro-4-naphthalenesulfonate and di-K 1-oxo-2-methyl-4-hydroxy-1,4-dihydro-3,4-naphthalenedisulfonate. 2-Methyl-1,4-naphthoquinone 4-(*p*-nitrophenylhydrazone), m. 267-7.5°, was prepd. and found to be identical with 2-methyl-4-(*p*-nitrophenylazo)-1-naphthol (cf. Lesser, Glaser, and Aczél, *C.A.* 8, 661).

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ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

Cd

1C

Bisulfite compounds. VI. Bisulfite compound of 2-naphthol-1-sulfonic acid. V. N. Ufimtsev. *J. Applied Chem.* (U.S.S.R.) 18, 214-16(1945); cf. preceding abstr. —2-Naphthylamine-1-sulfonic acid (10 g.) was refluxed with 50 cc. $KHSO_3$ soln. (d. 1.25) for 6 hrs. On cooling, there was obtained a mixt. of 2-naphthylamine-1-sulfonic acid and 2-naphthol-1-sulfonic acid; this was filtered off and the filtrate acidified to Congo red by 50% H_2SO_4 to yield 2-naphthylamine-1-sulfonic acid. The filtrate was kept overnight over KOH and H_2SO_4, treated with 50 cc. MeOH, filtered, and the filtrate was freed of SO_4 salts by $Pb(OAc)_2$, and the filtrate concd. *in vacuo* and treated with Me_2CO to give 1.91 g. *NH_4-K salt of 1,2-dihydro-2-naphthol-1,2-disulfonic acid.* This is the only crystallizable salt. Its acid solns. decomp. on concn. with evolution of 2-naphthol. G. M. Kosolapoff

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

Ca

10

Additivity of boiling points and chelated bond in aromatic compounds. V. N. Ufimtsev (Central Inst. of Malaria and Med. Parasitology, Moscow). *Compt. rend. acad. sci. U.R.S.S.* 49, 424-6(1945). —U. disputes the hypothesis of the H chelated bond for *o*-substituted derivs. of benzene, as advanced by Latimer and Rodebush (*C.A.* 14, 2740) and Sidgwick (*Electronic Theory of Valency* (*C.A.* 22, 544)). It is claimed that compds. having Me, CHO, CH_2OH, and SH groups form no H chelated bonds. Thus, substitution of the H in the CHO group by Me causes no large change in the b.p. The behavior of the b.ps. of the derivs. of aniline and even of $PhNMe_2$ (which contains no H directly bound to N) is similar to that of the corresponding phenols.

John W. Green

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

Ca

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Mechanism of formation of the intramolecular bond in
aromatic compounds. V. N. Ufimtsev. *Doklady Akad.*
Nauk S.S.S.R. **50**, 263-5(1945).—The formation of the
intramol. bond by basic groups (dialkylamino, alkylamino,
amino, acylamino, hydroxy) is conditioned by keto-enol
resonance. Amino, alkylamino, and dialkylamino groups
form the N-chelated bond by acquiring a pos. charge on
the N of the basic group, with a neg. charge being acquired
by the other group (or atom) participating in the bond
formation, by resonance with the aromatic ring. The
OH and acylamino groups can acquire a pos. charge by
ionization of H. MeO, Me, CH_2OH, CHO, and SH can-
not serve as the basic group. The 2nd group involved in
bond formation must belong to either of 2 types: (I)
CHO, Ac, MeO_2C, NO_2, NO—N:N—R, which facilitate
resonance of the basic groups; and (II) halogens, HO,
MeO, NH_2, Me_2N, which when located in the ortho position
are incapable of facilitating resonance of the basic groups,
but act either by partial ionization of H of the basic groups
or by partial ionization of the bond of the basic group with
the ring C. The exptl. work on which the discussion is
based has been presented earlier (U., *C.A.* 40, 6411[a]).

G. M. Kosolapoff

A S M - S L A METALLURGICAL LITERATURE CLASSIFICATION

UFIMTZEV, V. N.

"The reaction capacity of the naphthalene nucleus in the light of resonance conceptions" by V. N. Ufimtzev (p. 750)

SO: Journal of General Chemistry (Zhurnal Obshchei Khimii) 1946, Volume 16, No. 4-5