Werk

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Algebra und Zahlentheorie.

Obrechkoff, N.: Sui polinomi univalenti. Boll. Un. Mat. Ital. **14**, 246—249 (1935).

Soit z_0 la racine du polynôme: $\frac{f(z)}{z^p} = 1 + a_1 z^q + a_2 z^{2q} + \cdots + a_n z^{nq}$, la plus voisine de l'origine. L'A. démontre que le polynôme $f(z)$ est p-valent dans le cercle $|z| \leqq |z_0| \sqrt[q]{\frac{p}{qn+p}}$. La limite est atteinte pour le polynôme $z^p(z^q - z_0^q)^n$.
Mandelbrojt (Clermont-Ferrand).

Oldenburger, Rufus: Canonical triples of bilinear forms. Tôhoku Math. J. **41**, 216 bis 221 (1935).

The author considers triples $[A, B, C]$ of $n \times n$ matrices with complex elements where the pair A, B has distinct characteristic roots. A canonical form $[A_1, B_1, C_1]$ is obtained under transformations $A_1 = XAX^{-1}$, $B_1 = XBX^{-1}$, $C_1 = XCX^{-1}$.
MacDuffee (Madison).

Gantmacher, F., et M. Krein: Sur les matrices oscillatoires. C. R. Acad. Sci., Paris **201**, 577—579 (1935).

A matrix $A = \|a_{ik}\|_1^n$ is completely positive (non-negative) if all its minor determinants are positive (non-negative). A is oscillatory if it is completely non-negative and if A^α is completely positive for some integer α. The following results are stated. (1) A necessary and sufficient condition that a non-negative A be oscillatory is that $|a_{ik}|_1^n \neq 0$ and $a_{p,p+1}\, a_{p+1,p} \neq 0$ $(p = 1, \ldots, n-1)$. (2) The product of oscillatory matrices is oscillatory. (3) The characteristic roots of an oscillatory matrix are positive and distinct, and (4) those of $A = \|a_{ik}\|_1^n$ and $A_1 = \|a_{ik}\|_1^{n-1}$ separate each other. (5) The polynomials $\partial\,|a_{ik} - \lambda\varepsilon_{ik}|_1^n / \partial a_{ij}$, $(j = 1, \ldots, n)$, form a Sturm sequence. (6) The coördinates $u_{i1}, \ldots, u_{in}$ of a proper vector (pole) of A corresponding to λ_i have $i-1$ variations. (7) If $\lambda_1 > \lambda_2 > \cdots > \lambda_n$, a polar matrix U and a matrix $V = \|v_{ik}\|_1^n$ can be chosen so that for every $p \leqq n$, $|u_{ri_s}| > 0$, $|v_{ri_s}| > 0$ $(r = 1, \ldots, p$, $1 \leqq i_1 < \cdots < i_p \leqq n)$ and $UV' = A$. (8) The derivatives $\partial\lambda_j / \partial a_{ik}$ satisfy certain inequalities.
MacDuffee (Madison).

Andreoli, G.: Sulle funzioni di composizione di matrici. (Funzioni isogene.) Atti Accad. Sci. Fis. e Mat. Napoli, II. s. **20**, Nr 10, 1—31 (1935).

This is a critical analysis of the concept of function of a matrix as developed by the Italian mathematicians. An $n \times n$ matrix X is called a point in a cartesian space of n^2 dimensions. A variety of Volterra is a set W of matrices commutative with X and with each other. A fundamental W is represented by a direct sum of r blocks of the type $X^{(m)} = x_0^{(m)} I + x_1^{(m)} D + x_2^{(m)} D^2 + \cdots$ where $D = (\delta_{r,s+1})$. Other varieties of Volterra are transforms of these. The space of commutativity of W is composed of all matrices commutative with every matrix of W. In this space can be defined analytic function, derivative, integral, etc., and in it Cauchy's integral theorem holds. If $f(x)$ has ν determinations when x is a complex variable, then $f(X)$ has ν^r determinations, since the $f(X^{(m)})$ may come from different determinations of f. This justifies the definition of function of Cipolla [Rend. Circ. mat. Palermo **56**, 144—154 (1932); this Zbl. **4**, 338].
MacDuffee (Madison).

Hua, Loo-keng: On a certain kind of operations connected with linear algebra. Tôhoku Math. J. **41**, 222—246 (1935).

The paper is concerned with the automorphisms of linear algebras and moduls. In Part I the author investigates algebras which admit a given automorphism, the method requiring that the field of the coefficients be algebraically closed. In Part II he defines decomposition group and inertial group for moduls and uses them to study groups of modular transformations. *MacDuffee* (Madison).

Morin, U.: Sulla potenza delle basi di gruppi e corpi. Rend. Circ. mat. Palermo **59**, 74—81 (1935).

D'une étude simple des isomorphismes des groupes abéliens avec opérateurs, l'auteur déduit que: une base algébrique non finie d'un corps (par rapport à son sous-corps premier) a même puissance que le corps, d'où l'égalité des puissances de deux bases algébriques d'un même corps (Steinitz). *P. Dubreil* (Nancy).

Stone, M. H.: Postulates for Boolean algebras and generalized Boolean algebras. Amer. J. Math. **57**, 703—732 (1935).

Ein System von Axiomen für sog. Boolesche Algebren, also algebraische Bereiche doppelter Komposition, die den Axiomen der Klassenlogik genügt. Die Axiome des Verf. sind voneinander unabhängig. Außerdem wird in der Arbeit das Axiomensystem des Verf. mit den anderen Systemen (von Huntington und Del Re) konfrontiert, so daß eine bequeme und nützliche Zusammenstellung der verschiedenen Axiomensysteme entsteht. Auch die verallgemeinerten Booleschen Algebren (in denen ein Null- und ein Einselement nicht notwendig auftreten) werden in gleicher sorgfältiger Weise behandelt. *P. Alexandroff* (Moskau).

Brahana, H. R.: Note on irreducible quartic congruences. Trans. Amer. Math. Soc. **38**, 395—400 (1935).

The author considers the irreducible quartic polynomials in the modular field defined by an odd prime p. Under the transformations of the linear fractional group with coefficients mod p these fall into $\frac{1}{2}(p+1)$ sets of conjugates. If p is greater than three any two quartics which are conjugate under the group have the same absolute invariant i, and conversely. The invariant i can take on $\frac{1}{2}(p+1)$ different values, namely infinity and the $\frac{1}{2}(p-1)$ values for which $i-27$ is a quadratic non-residue mod p. Finally the author gives a method for determining a member of each of the conjugate sets. *J. A. Todd* (Manchester).

Dickson, L. E.: Cyclotomy, higher congruences, and Waring's problem. II. Amer. J. Math. **57**, 463—474 (1935).

To supplement analytic methods for proving that every sufficiently large integer is a sum of s values (for integers $x \geqq 0$) of a given (primitive) polynomial in x of degree k, it is expedient to consider the number n such that a sum of n such values represents every residue to modulus p, for all primes p not dividing k; and to see that the maximum such n for all p's and polynomials of degree k does not exceed s. In particular, Dickson finds that $n=4$ if $k=3 (s=9)$, $n=6$ if $k=4 (s=19), \ldots, n=216$ if $k=10 (s=2113)$; $n \leqq 8.3^{\frac{1}{2}k-2} < s$ for even $k \leqq 18$; $n(k,p) \leqq 2n(k-1,p)$ for odd k, and a like result for even k; whence $n < s$ for at least $k < 28$. The congruence $x^k + y^k \equiv -1 \pmod{p}$ is investigated, the results of I. (this Zbl. 12, 12) being employed. *G. Pall* (Montreal).

Pall, Gordon: Binary quadratic discriminants differing by square factors. Amer. J. Math. **57**, 789—799 (1935).

Die bisherigen Untersuchungen über das Problem: „Es sollen alle Darstellungen von Zahlen (n) durch ganzzahlige quadratische Formen mit der Diskriminante d, wobei $(n, d) \neq 1$, gefunden werden", sind kompliziert. Der Verf. will einen einfacheren naturgemäßeren Weg einschlagen und gibt dazu einen Beitrag. Es handelt sich hier darum, Untersuchungen über Klassen ganzzahliger Formen mit der Diskriminante $p^2 d$ auf solche mit der Diskriminante d zurückzuführen. Es wird gezeigt, wie sich diese Klassen durch ganzzahlige Transformationen mit der Determinante p überführen lassen, und es werden Folgerungen über die Darstellung von Zahlen durch solche Klassen von quadratischen Formen gezogen. *Hofreiter* (Wien).