

$t$  shows green (red) for the horizontal line through  $P_{ij}$  and red (green) for the vertical. Various questions are asked of  $S$ , notably those concerning the possibility of non-stop travel along all horizontal and vertical paths through the point network. Those systems  $S$  admitting "through" speeds are determined and for each such  $S$  all through speeds are found. Such problems are solved by the theory of simultaneous congruences. The results are applied to the determination of the synchronization for the "best" flow of traffic. Consideration of "almost" through speeds and more general problems in traffic control is deferred to a later paper. (Received October 19, 1943.)

43. František Wolf: *On a problem of L. M. K. Boelter. Viscous fluid forced through a heated vertical pipe.*

The temperature at the wall is prescribed to be  $t^\circ = \lambda \coth mz + \mu$ , independent of  $\theta$ . The density and viscosity are analytic functions of  $t$ . There are four differential equations of which three are of the second order. Solving Stokes' hydrodynamical equations for a cylinder, we obtain a set of integro-differential equations which can be used for successive approximations. The chief difficulty is in determining the boundary value of the pressure which, generally, is determined by an integral equation. After some preliminary changes of the differential system, the Laplace transformation can be applied. This leads to an algebraic equation for the transform of the boundary value of the pressure. A later paper will be devoted to the study of the convergence of the successive approximations and to the problem of the existence of the solution. (Received October 28, 1943.)

#### ERGODIC THEORY

44. P. R. Halmos: *In general a measure preserving transformation is mixing.*

The first proof is given of the old standing conjecture announced in the title. "In general" means of course that the exceptional set is of the first category in one of the usual natural topologies (the strong neighborhood topology) for measure preserving transformations. The principal new and quite surprising fact used in the proof is that for any almost nowhere periodic transformation  $T$  the set of all conjugates of  $T$ , that is, the set of all  $STS^{-1}$ , is everywhere dense. (Received October 26, 1943.)

#### GEOMETRY

45. V. G. Grove: *The transformation of Čech.*

The purpose of this paper is to give a simple geometric construction of the general transformation of Čech. This is accomplished by first constructing a two parameter family of quadrics having second order contact with a surface and associated in a simple manner with a conjugate net on the surface. The polar plane of a point on the tangent to a curve of the net with respect to a quadric of the family is related to that point by a general transformation of Čech. Geometrical characterizations are made for several particular transformations of Čech. (Received November 19, 1943.)

46. Janet MacDonald: *Conjugate nets in asymptotic parameters.*

This paper presents some contributions to the projective differential geometry of conjugate nets in asymptotic parameters on an analytic nonruled surface in ordinary space. The equation of the bundle of quadrics each of which has contact of at least

the third order with both curves of a conjugate net at a point is deduced, and the cones in the bundle and the intersections of the bundle with the tangent plane are studied. Certain polar relations with respect to the quadrics of the bundle are presented. Certain loci and envelopes are investigated at a point of the surface in connection with a pencil of conjugate nets. Among these are the principal cubic, which is the locus of the principal points, and the principal conic, which is the envelope of the principal joins. Davis (*Contributions to the theory of conjugate nets*, doctoral dissertation, Chicago, 1932) defined and studied several canonical configurations, considering the conjugate net as parametric. In the present paper a study is made of Davis's canonical configurations in asymptotic parameters. (Received October 21, 1943.)

47. E. J. Purcell: *Variety congruences of order one in  $n$ -dimensional space.*

A variety congruence of order one in  $[n]$  is an algebraic  $\infty^h$ -system of varieties, each of dimension  $n-k$  and order  $h$ , in  $n$ -dimensional projective space, such that through a generic point of  $[n]$  one and only one  $V_{n-k}^h$  of the system passes ( $k$  any positive integer not greater than  $n$ , and  $h$  any positive integer). The results of very many writers on Cremona transformations, Cremona involutions,  $(1, m)$  correspondences, and line or curve congruences of order one can be obtained by specializing this paper. (Received October 7, 1943.)

#### TOPOLOGY

48. K. T. Millsaps: *A note on generalized Hilbert space.*

By analyzing an example formulated by A. Tychonoff, *Math. Ann.* vol. 111 (1935) p. 768, the spaces  $H^\rho$ ,  $0 \leq \rho \leq \infty$ , are defined in a manner analogous to that for classical Hilbert space; some basic properties such as linearity, necessary and sufficient conditions for normability, completeness, separability, and sufficient conditions for local non-convexness are proved. (Received October 30, 1943.)

49. R. L. Moore: *Concerning webs in the plane.*

Among other things it is shown that if a compact plane continuum contains a web it is one. (Received November 25, 1943.)

50. M. E. Shanks: *Monotone decompositions of continua.*

In this paper the author considers the lattice  $\mathcal{D}_m(X)$  of all monotone upper semi-continuous decompositions of the compactum  $X$ . This lattice is well suited for the study of the structure of continua. Two continua  $X$  and  $Y$  are homeomorphic if and only if there is an isomorphism carrying  $\mathcal{D}_m(X)$  onto  $\mathcal{D}_m(Y)$  which makes simple decompositions correspond to simple decompositions. By means of a factorization theorem it is shown that if  $X$  is a dendrite or a linear graph then  $\mathcal{D}_m(X)$  is isomorphic to  $\mathcal{D}_m(A)$ , where  $A$  is an arc. Spaces for which  $\mathcal{D}_m(X)$  is isomorphic to  $\mathcal{D}_m(A)$  are hereditarily locally connected. A class of continua called generalized dendrites is defined and characterized as those continua for which  $\mathcal{D}_m(X)$  is a sublattice of the lattice of all upper semi-continuous decompositions of  $X$ . Both dendrites and Knaster continua are generalized dendrites, and both make  $\mathcal{D}_m(X)$  distributive. A characterization of dendrites is obtained. (Received October 22, 1943.)