Topology

99. C. L. Clark: *Arc reversing transformations.*

If A and B are separable metric spaces, B nondegenerate, a single-valued continuous transformation $f(A)=B$ is said to be arc reversing provided the inverse of every simple arc in B is a simple arc in A. After several basic results are obtained, it is shown that if $f(A)=B$ is arc reversing, with A locally compact and B a locally connected generalized continuum, then the sets $A-A_1$ and $B-B_1$ are homeomorphic, where B_1 is the set of all points b in B whose inverses $f^{-1}(b)$ are nondegenerate and $A_1=f^{-1}(B_1)$. In particular if $f(A)=B$ is (1-1), A and B are homeomorphic. A characterization of arc reversing transformations is afforded by the result that a single-valued continuous transformation $T(A)=B$, where A and B are locally connected continua, is arc reversing if and only if the set of inverses $[T^{-1}(b)]$, b in B, consists of single points and at most a countable number of free arcs whose end points are of Urysohn-Menger order at most 2 in A. Further results are obtained concerning local separating points and continua having homeomorphs of finite linear measure. (Received December 29, 1943.)

100. Mariano García: *Component orbits under pointwise recurrent homeomorphisms.*

A point x of a separable metric space X on which a homeomorphism $f(X)=X$ is defined is called recurrent under f if, given any neighborhood U of x, there exists an N such that $f^N(x)\in U$, and an invariant set L in X whose components can be ordered in a sequence $\cdots, A_{-2}, A_{-1}, A_0, A_1, A_2, \cdots$ such that $f(A_i)=A_{i+1}$ is defined as a component orbit. Using methods analogous to those used by Whyburn in proving the results that Hall and Schweigert obtained relative to periodic component orbits (component orbits having a finite number of components) under a pointwise periodic homeomorphism on X, this paper establishes extensions of these results to non-pointwise periodic mappings. It is shown for example that if $f(X)=X$ is a homeomorphism on a compact space X and $G_1, G_2, \cdots$ is a sequence of component orbits whose limit inferior contains a periodic component orbit Q, and if (either) each point of $\limsup G_i-Q$ is recurrent under both f and f^{-1} or each point of $\sum_{i=1}^{\infty} G_i+\limsup G_i$ is recurrent under f, then $\limsup G_i$ is a periodic component orbit. (Received December 27, 1943.)

101. W. H. Gottschalk: *Powers of homeomorphisms with almost periodic properties.*

Let X be a topological space and let $f(X)=X$ be a homeomorphism. A point x of X is said to be *recurrent* under f provided that to each neighborhood U of x there corresponds a positive integer n such that $f^n(x)\in U$. A point x of X is said to be *almost periodic* under f provided that to each neighborhood U of x there corresponds a monotone increasing sequence $n_1, n_2, \cdots$ of positive integers with the properties that the numbers $n_{i+1}-n_i$ $(i=1, 2, \cdots)$ are uniformly bounded and $f^{n_i}(x)\in U$ $(i=1, 2, \cdots)$. A subset Y of X is said to be *minimal* under f provided that Y is nonvacuous, closed and invariant under f, and furthermore Y does not contain a proper subset with these properties. The following theorems are established: (1) If $x\in X$ is recurrent under f, then x is also recurrent under f^n for every positive integer n. (2) If X is minimal under f but not under f^k, where k is a nonzero integer, then there exists an integer n, $n>1$, such that n divides $|k|$ and f^n gives a finite minimal-set decomposition of X which