79. On Almost Periodic Transformations on Uniform Spaces

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In this Note, we shall state some theorems on almost periodic transformations on uniform spaces. W. H. Gottschalk introduced the notion of almost periodic transformation on a topological space X in itself, and W. H. Gottschalk (2), P. Erdös and A. H. Stone (1) obtained some theorems on almost periodic transformations on metric spaces.

Let X be a uniform space, and f a continuous mapping of X in itself.

f is said to be strongly almost periodic if, for a surrounding U, there is an integer $N > 0$ such that every set of N consecutive integers contains an n satisfying $(x, f^n(x)) \in U$ for all $x \in X$.

f is said to be strongly recurrent, if for any given surrounding U, there is infinitely many n such that $(x, f^n(x)) \in U$.

Then we have the following theorems.

Theorem 1. If a uniformly continuous map f of a uniform space X in itself is strongly recurrent, then so is f^k for every k.

Theorem 2. If a uniformly continuous map f of a uniform space X into itself is strongly almost periodic, then so is f^k for every k.

Theorem 3. If X is a precompact uniform space and if f is a homeomorphism on X such that the family of negative powers of f is uniformly equicontinuous, then f is strongly almost periodic.

References

1) P. Erdös and A. H. Stone: Some remarks on almost periodic transformations, Bull. Amer. Math. Soc., **51**, 126-130 (1945).
2) W. H. Gottschalk: Powers of homeomorphisms with almost periodic properties, Bull. Amer. Math. Soc., **50**, 222-227 (1944).