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On Mixing Properties for Semigroups of Operators

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AMS Classification: 47A16, 47D03

Keywords and phrases: Hypercyclic Semigroup, Topologically Mixing Semigroup, Translation Semigroup

Let X be a separable Banach space and let Δ be R, R^+ or a sector in the complex plane. Let $\{T_t\}_{t\in\Delta}$ be a strongly continuous semigroup of linear and continuous operators $T_t : X \to X$ for all $t \in \Delta$. We say that $\{T_t\}_{t\in\Delta}$ is a **hypercyclic** semigroup if there is any element in X with dense orbit by the semigroup. We say that $\{T_t\}_{t\in\Delta}$ is a **topologically mixing** semigroup if for every pair of non void open sets $U, V \subset X$ there exists $r > 0$ such that $T_t(U) \cap V \neq \emptyset$ for every $t \in \Delta$ with $|t| \geq r$. Every topologically mixing semigroup is hypercyclic, but the converse is false. The semigroup $\{T_t\}_{t\in\Delta}$ is said to be **weakly mixing** if $\{T_t \oplus T_t\}_{t\in\Delta}$ is hypercyclic on the direct sum $X \oplus X$. These properties are strongly related to the concept of chaos for semigroups.

We characterize hypercyclicity and mixing properties of translation semigroups defined on some weighted spaces of integrable and continuous functions on Δ, generalizing some results of [2]. In this setting, we give some counterexamples that complete the given characterizations.

References

[1] J. Bès and A. Peris, *Hypercyclic and Chaotic Semigroups of Linear Operators,* J. Funct. Anal. 167 (1999), 94-112.

[2] W. Desch, W. Schappacher and G.F. Webb, *Hypercyclic and Chaotic Semigroups of Linear Operators,* Ergod. Th. & Dynam. Systems 17 (1997), 793-819.