46th Annual Iranian Mathematics Conference
25-28 August 2015
Yazd University

Disjoint Hypercyclicity of Composition Operators on the Weighted Dirichlet Spaces

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Abstract

In this paper, we discuss disjoint hypercyclicity of composition operators on some Weighted Dirichlet spaces.

Keywords: Hypercyclicity, Disjoint hypercyclicity, composition operators, Weighted Dirichlet spaces.
Mathematics Subject Classification [2010]: 47A16, 47B33, 47B38

1 Introduction

Let X be a topological vector space and T a bounded linear operator on X. The T-orbit of a vector $x \in X$ is the set

$$O(x,T) := \{T^n(x) : n \in \mathbb{N} \cup \{0\}\}.$$

Definition 1.1. The operator T is said to be hypercyclic if there exists a vector $x \in X$ such that $O(x,T)$ is dense in X. Such a vector x is said to be hypercyclic vector for T.

It is known that the direct sum of two hypercyclic operators need not be hypercyclic, see [5]. Finitely many hypercyclic operators acting on a common topological vector space are called disjoint if their direct sum has a hypercyclic vector on the diagonal of the product space.

Definition 1.2. For $N \geq 2$, the operators $T_1, T_2, ..., T_N$ are called disjoint hypercyclic or d-hypercyclic if the direct sum $T_1 \oplus T_2 \oplus ... \oplus T_N$ has a hypercyclic vector of the form $(x, x, ..., x) \in X^N$.

Definition 1.3. Let $\{\beta(n)\}_{n=0}^{\infty}$ be a sequence of positive numbers with $\beta(0) = 1$. The Weighted Hardy space $H^2(\beta)$ is defined as the space of functions $f = \sum_{n=0}^{\infty} \hat{f}(n) z^n$ analytic on $\mathbb{D}$ such that $\| f \|_{\beta}^2 = \sum_{n=0}^{\infty} \mid \hat{f}_n \mid^2 \beta(n)^2 < \infty$. Let $\beta(n) = (n+1)^{\nu}$, where ν is a real number. These spaces are known as weighted Dirichlet spaces or $\mathcal{S}_{\nu}$.

Definition 1.4. Let φ be a holomorphic self map of unit disk $\mathbb{D}$. A composition operator on $\mathcal{S}_{\nu}$, C_{φ}, is defined by $C_{\varphi} f = f o \varphi$ for all $f \in \mathcal{S}_{\nu}$.

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