

# Surveys Of Some Recent Results In Operator Theory

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## Real complex functions

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ABSTRACT. We survey a few classes of analytic functions on the disk that have real boundary values almost everywhere on the unit circle. We explore some of their properties, various decompositions, and some connections these functions make to operator theory.

### 1. Introduction

In this survey paper we explore certain classes of analytic functions on the open unit disk  $\mathbb{D}$  that have real non-tangential limiting values almost everywhere on the unit circle  $\mathbb{T}$ . These classes enjoy some remarkable analytic, algebraic, and structural properties that connect to various problems in operator theory. In particular, these classes can be used to describe the kernel of a Toeplitz operator on the Hardy space  $H^2$ ; to give an alternate description of the pseudocontinuable functions on  $H^2$  (alternatively the non-cyclic vectors for the backward shift operator); to define a class of unbounded symmetric Toeplitz operators on  $H^2$ ; and to define an analogue of the classical Riesz projection operator for the Hardy spaces  $H^p$  when  $0 < p < 1$ .

Much of this material originates in the papers [13–15], which, in turn, stem from seminal work of Aleksandrov [2, 3] and Helson [20, 21]. We do, however, provide many new examples and a few novel results not discussed in the works above. We also endeavor to make this survey accessible and thus include as many proofs as reasonable. We hope the reader will be able to follow along and eventually make their own contributions.

### 2. Function spaces

In this section we review a few definitions and basic results needed for this survey. The details and proofs can be found in the well-known texts [10, 16].

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