Ji Li

Macquarie University

Weak factorization of Hardy spaces and characterization of BMO spaces in the Bessel setting and applications

Abstract

It is well-known that the classical Hardy space H^p, $0 < p < \infty$ on the unit disc $\mathbb{D} = \{z \in \mathbb{C} : \ |z| < 1\}$ has the factorization property, which is known as *the Riesz factorization theorem*: *"A function f is in $H^1(\mathbb{D})$ if and only if there exist $g, h \in H^2(\mathbb{D})$ with $f = g \cdot h$ and $\|f\|_{H^1(\mathbb{D})} = \|g\|_{H^2(\mathbb{D})}\|h\|_{H^2(\mathbb{D})}$."* This factorization plays an important role in studying function theory and operator theory connected to the spaces $H^1(\mathbb{D})$, $H^2(\mathbb{D})$ and the space $BMOA(\mathbb{D})$ (analytic BMO). The analogue of the Riesz factorization theorem, sometimes referred to as strong factorisation, is not true for real-variable Hardy space $H^1(\mathbb{R}^n)$. Nevertheless, Coifman, Rochberg and Weiss provided a suitable replacement that works in studying function theory and operator theory of $H^1(\mathbb{R}^n)$, the weak factorization via a bilinear form related to the Riesz transform (Hilbert transform in dimension 1).

We study the analogue of the result of Coifman, Rochberg and Weiss for the Hardy spaces associated with the Bessel operator Δ_λ studied by Weinstein, Huber, Muckenhoupt and Stein. Then we further provide a characterization of BMO spaces associated with Δ_λ in terms of the commutators related to the Riesz transform $\nabla\Delta_\lambda^{-1/2}$.

This is joint work with Xuan Duong, Brett D. Wick and Dongyong Yang.

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Special Session: Harmonic analysis. Organized by K. Bickel.