

INHOMOGENEOUS LIPSCHITZ SPACES ASSOCIATED WITH FLAG SINGULAR INTEGRALS AND THEIR APPLICATIONS

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Abstract. This note is motivated by Müller, Ricci and Stein's work in [29]. We introduce a new class of inhomogeneous Lipschitz spaces associated with flag singular integrals and characterize these spaces via the Littlewood-Paley theory. We prove that inhomogeneous flag singular integral operators are bounded on these Lipschitz spaces.

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REFERENCES

- [1] S.-Y. A. CHANG AND R. FEFFERMAN, *A continuous version of duality of H^1 with BMO on the bidisc*, Ann. of Math., **112**, 1 (1980), 179–201.
- [2] S.-Y. A. CHANG AND R. FEFFERMAN, *The Calderón-Zygmund decomposition on product domains*, Amer. J. Math., **104**, 3 (1982), 455–468.
- [3] S.-Y. A. CHANG AND R. FEFFERMAN, *Some recent developments in Fourier analysis and H^p theory on product domains*, Bull. Amer. Math. Soc., **12**, 1 (1985), 1–43.
- [4] D.-C. CHANG, Y. HAN AND X. WU, *Relations between product and flag Hardy Spaces*, J. Geom. Anal., **31**, 7 (2021), 382–395.
- [5] J. CHEEGER, *Differentiability of Lipschitz functions on metric measure spaces*, Geom. Funct. Anal., **9**, 3 (1999), 428–517.
- [6] X. DUONG, J. LI, Y. OU, J. PIPHER AND B. WICK, *Commutators of multiparameter flag singular integrals and applications*, Anal. PDE, **12**, 5 (2019), 1325–1355.
- [7] R. FEFFERMAN, *Singular integrals on product H^p spaces*, Rev. Mat. Iberoam., **1**, 2 (1985), 25–31.
- [8] R. FEFFERMAN, *Calderón-Zygmund theory for product domains: H^p spaces*, Proc. Nat. Acad. Sci. U.S.A., **83**, 4 (1986), 840–843.
- [9] R. FEFFERMAN, *Harmonic analysis on product spaces*, Ann. of Math., **126**, 1 (1987), 109–130.
- [10] R. FEFFERMAN AND J. PIPHER, *Multiparameter operators and sharp weighted inequalities*, Amer. J. Math., **119**, 2 (1997), 337–369.
- [11] R. FEFFERMAN AND E. M. STEIN, *Singular integrals on product spaces*, Adv. Math., **45**, 2 (1982), 117–143.
- [12] M. FRAZIER AND B. JAWERTH, *A discrete transform and decomposition of distribution*, J. Funct. Anal., **93**, 1 (1990), 34–170.
- [13] M. FRAZIER, B. JAWERTH AND G. WEISS, *Littlewood-Paley theory and the study of function spaces*, CBMS Regional Conference Series in Mathematics, **79**, American Mathematical Society, Providence, R.I., 1991, viii+132 pp.
- [14] D. GOLDBERG, *A local version of real Hardy spaces*, Duke Math. J., **46**, 1 (1979), 27–42.
- [15] R. GUNDY AND E. M. STEIN, *H^p theory for the poly-disk*, Proc. Nat. Acad. Sci., **76**, 3 (1979), 1026–1029.
- [16] Y. HAN AND Y. HAN, *Boundedness of composition operators associated with mixed homogeneities on Lipschitz spaces*, Math. Res. Lett., **23**, 5 (2016), 1387–1403.
- [17] Y. HAN, Y. HAN, J. LI AND C. TAN, *Marcinkiewicz multipliers and Lipschitz Spaces on Heisenberg groups*, Canad. J. Math., **71**, 3 (2019), 607–627.