

MULTILINEAR OFF-DIAGONAL LIMITED RANGE EXTRAPOLATIONS

YASUO KOMORI-FURUYA

Abstract. We study the Rubio de Francia's extrapolation theorem. We prove an off-diagonal limited range extrapolation theorem. Using this theorem, we obtain a multilinear off-diagonal limited range extrapolation theorem. Our results generalize and refine known results by Duoandikoetxea (2011), Cruz-Uribe and Martel (2018) and Li, Martell and Ombrosi (2020).

Mathematics subject classification (2020): 42B25, 42B20.

Keywords and phrases: Rubio de Francia's extrapolation theorem, multilinear extrapolation, off-diagonal limited range extrapolation.

REFERENCES

- [1] P. AUSCHER AND J. M. MARTELL, *Weighted norm inequalities, off-diagonal estimates and elliptic operators. I. General operator theory and weights*, Adv. Math. **212** no. 1, 225–276 (2007).
- [2] P. AUSCHER AND J. M. MARTELL, *Weighted norm inequalities for fractional operators*, Indiana Univ. Math. J. **57** no. 4, 1845–1869 (2008).
- [3] M. CAO, J. J. MARÍN AND J. M. MARTELL, *Extrapolation on function and modular spaces, and applications*, Adv. Math. **406** (2022), No. 108520.
- [4] D. CRUZ-URIBE AND J. M. MARTELL, *Extrapolation from A_∞ weights and applications*, J. Funct. Anal. **213** no. 2, 412–439 (2004).
- [5] D. CRUZ-URIBE AND J. M. MARTELL, *Limited range multilinear extrapolation with applications to the bilinear Hilbert transform*, Math. Ann. **371** no. 1–2, 615–653 (2018).
- [6] D. CRUZ-URIBE, J. M. MARTELL, AND C. PÉREZ, *Weights, extrapolation and the theory of Rubio de Francia*, Operator Theory: Advances and Applications **215**, Birkhäuser/Springer Basel AG, Basel, 2011.
- [7] D. CRUZ-URIBE AND C. PÉREZ, *Two weight extrapolation via the maximal operator*, J. Funct. Anal. **174** no. 1, 1–17 (2000).
- [8] J. DUOANDIKOETXEA, *Extrapolation of weights revisited: new proofs and sharp bound*, J. Funct. Anal. **260** no. 6, 1886–1901 (2011).
- [9] J. GARCÍA-CUERVA AND J. L. RUBIO DE FRANCIA, *Weighted norm inequalities and related topics*, North-Holland Mathematics Studies, **116**, North-Holland Publishing Co., Amsterdam, 1985.
- [10] L. GRAFAKOS, *Classical Fourier Analysis, 3rd ed.*, Graduate Texts in Mathematics **249**, Springer, New York, 2014.
- [11] L. GRAFAKOS AND J. M. MARTELL, *Extrapolation of weighted norm inequalities for multivariable operators and applications*, J. Geom. Anal. **14** no. 1, 19–46 (2004).
- [12] E. HARBOURE, R. A. MACÍAS AND C. SEGOVIA, *Extrapolation results for classes of weights*, Amer. J. Math. **110** no. 3, 383–397 (1988).
- [13] R. JOHNSON AND C. J. NEUGEBAUER, *Change of variable results for A_p - and reverse Hölder RH_p -classes*, Trans. Amer. Math. Soc. **328** no. 2, 639–666 (1991).
- [14] M. LACEY AND C. THIELE, *L^p estimates on the bilinear Hilbert transform for $2 < p < \infty$* , Ann. of Math. (2) **146** no. 3, 693–724 (1997).
- [15] M. LACEY AND C. THIELE, *On Calderón's conjecture*, Ann. of Math. (2) **149** no. 2, 475–496 (1999).
- [16] K. LI, J. M. MARTELL AND S. OMBROSI, *Extrapolation for multilinear Muckenhoupt classes and applications*, Adv. Math. **373**, 107286, 43 pp. (2020).
- [17] J. L. RUBIO DE FRANCIA, *Factorization and extrapolation of weights*, Bull. Amer. Math. Soc. (N.S.) **7** no. 2, 393–395 (1982).

- [18] J. L. RUBIO DE FRANCIA, *Factorization theory and A_p weights*, Amer. J. Math. **106** no. 3, 533–547 (1984).