

THE MOLECULAR DECOMPOSITION OF HERZ–MORREY–HARDY SPACES WITH VARIABLE EXPONENTS AND ITS APPLICATION

JINGSHI XU AND XIAODI YANG

Abstract. The molecular decomposition of Herz–Morrey–Hardy spaces with variable exponents is given. As its application, the boundedness of a convolution type singular integral on Herz–Morrey–Hardy spaces with variable exponents is obtained.

Mathematics subject classification (2010): Primary 46E35; Secondary 42B25, 42B35.

Keywords and phrases: Variable exponent, Herz space, Morrey space, Hardy space, molecular characterization.

REFERENCES

- [1] A. ALMEIDA AND D. DRIHEM, *Maximal, potential and singular type operators on Herz spaces with variable exponents*, J. Math. Anal. Appl. **394** (2012), no. 2, 781–795.
- [2] A. ALMEIDA, J. HASANOV AND S. SAMKO, *Maximal and potential operators in variable exponent Morrey spaces*, Georgian Math. J. **15** (2008), no. 2, 195–208.
- [3] A. ALMEIDA AND P. HÄSTÖ, *Besov spaces with variable smoothness and integrability*, J. Funct. Anal. **258** (2010), no. 5, 1628–1655.
- [4] C. CHENG AND J. XU, *Geometric properties of Banach space valued Bochner-Lebesgue spaces with variable exponent*, J. Math. Inequal. **7** (2013), no. 3, 461–475.
- [5] D. CRUZ-URIBE AND A. FIORENZA, *Variable Lebesgue Spaces*, Springer, Heidelberg, Germany, 2013.
- [6] L. DIENING, P. HARJULEHTO, P. HÄSTÖ AND M. RŮŽIČKA, *Lebesgue and Sobolev spaces with variable exponents*, Springer, Berlin, Germany, 2011.
- [7] L. DIENING, P. HÄSTÖ AND S. ROUDENKO, *Function spaces of variable smoothness and integrability*, J. Funct. Anal. **256** (2009), no. 6, 1731–1768.
- [8] B. DONG AND J. XU, *New Herz type Besov and Triebel-Lizorkin spaces with variable exponents*, J. Funct. Spaces Appl. **2012** (2012), Article ID 384593, 27 pages.
- [9] B. DONG AND J. XU, *Local characterizations of Besov and Triebel-Lizorkin spaces with variable exponent*, J. Funct. Spaces Appl. **2014** (2014), Article ID 162518, 12 pages.
- [10] B. DONG AND J. XU, *Herz–Morrey type Besov and Triebel-Lizorkin spaces with variable exponents*, Banach J. Math. Anal. **9** (2015), no. 1, 75–101.
- [11] J. FU AND J. XU, *Characterizations of Morrey type Besov and Triebel-Lizorkin spaces with variable exponents*, J. Math. Anal. Appl. **381** (2011), no. 1, 280–298.
- [12] M. IZUKI, *Boundedness of sublinear operators on Herz spaces with variable exponent and application to wavelet characterization*, Anal. Math. **36** (2010), no. 1, 33–50.
- [13] H. KEMPKA, *2-Microlocal Besov and Triebel-Lizorkin spaces of variable integrability*, Rev. Mat. Complut. **22** (2009), no. 1, 227–251.
- [14] H. KEMPKA, *Atomic, molecular and wavelet decomposition of generalized 2-microlocal Besov spaces*, J. Funct. Spaces Appl. **8** (2010), no. 2, 129–165.
- [15] O. KOVÁČIK AND J. RÁKOSNÍK, *On spaces $L^{p(x)}$ and $W^{k,p(x)}$* , Czechoslovak Math. J. **41** (1991), no. 4, 592–681.
- [16] S. LU, D. YANG AND G. HU, *Herz type spaces and their applications*, Science Press, Beijing, 2008.
- [17] A. MAZZUCATO, *Decomposition of Besov–Morrey Spaces, Harmonic Analysis at Mount Holyoke*, AMS Series in Contemporary Mathematics **320** (2003), 279–294.

- [18] A. MAZZUCATO, *Besov-Morrey Spaces: Function Space Theory and Applications to Non-Linear PDE*, Trans. Amer. Math. Soc. **355** (2003), 1297–1364.
- [19] E. NAKAI AND Y. SAWANO, *Hardy spaces with variable exponents and generalized Campanato spaces*, J. Funct. Anal. **262** (2012), no. 9, 3665–3748.
- [20] P. ROCHA AND M. URCIUOLO, *Fractional type integral operators on variable Hardy spaces*, Acta Math. Hungar. **143** (2014), no. 2, 502–514.
- [21] C. SHI AND J. XU, *Herz type Besov and Triebel-Lizorkin spaces with variable exponents*, Front. Math. China, vol. 8, no. 4, pp. 907–921, 2013.
- [22] S. SAMKO, *Variable exponent Herz spaces*, *Mediterr. J. Math.*, vol. 10, no. 4, pp. 2007–2025, 2013.
- [23] Y. SAWANO, *Wavelet characterization of Besov-Morrey and Triebel-Lizorkin-Morrey spaces*, *Funct. Approx. Comment. Math.* **38** (2008), 93–108.
- [24] Y. SAWANO, *Besov-Morrey spaces and Triebel-Lizorkin-Morrey spaces on domains in \mathbb{R}^n* , *Math. Nachr.* **283** (2010), 1456–1487.
- [25] Y. SAWANO AND H. TANAKA, *Decompositions of Besov-Morrey spaces and Triebel-Lizorkin-Morrey spaces*, *Math. Z.* **257** (2007), no. 4, 871–905.
- [26] M. H. TAIBLESON AND G. WEISS, *The molecular characterization of certain Hardy spaces*, *Astérisque* **77** (1980), 67–149.
- [27] L. TANG AND J. XU, *Some properties of Morrey type Besov-Triebel spaces*, *Math. Nachr.* **278** (2005), no. 7–8, 904–917.
- [28] H. TRIEBEL, *Local Function Spaces, Heat and Navier-Stokes Equations*, European Mathematical Society, 2013.
- [29] H. WANG AND Z. LIU, *The Herz-type Hardy spaces with variable exponent and their applications*, *Taiwanese J. Math.* **16** (2012), no. 4, 1363–1389.
- [30] J. XU, *Variable Besov spaces and Triebel-Lizorkin spaces*, *Ann. Acad. Sci. Fenn. Math.* **33** (2008), 511–522.
- [31] J. XU, *An atomic decomposition of variable Besov and Triebel-Lizorkin spaces*, *Armenian J. Math.* **2** (2009), 1–12.
- [32] J. XU, *Decompositions of non-homogeneous Herz type Besov and Triebel-Lizorkin spaces*, *Sci. China Math.* **57** (2014), no. 2, 315–331.
- [33] J. XU AND X. YANG, *Herz-Morrey-Hardy spaces with variable exponents and their applications*, *J. Function Spaces* **2015** (2015), Article ID 160635, 19 pages.
- [34] J. XU AND X. YANG, *Variable exponent Herz type Besov and Triebel-Lizorkin spaces*, *Georgian Math. J.*, accepted.
- [35] W. YUAN, W. SICKEL AND D. YANG, *Morrey and Campanato Meet Besov, Lizorkin and Triebel*, Lecture Notes in Mathematics **2005**, Springer, 2010.