

WEIGHTED COMPOSITION OPERATOR ON TWO-DIMENSIONAL LORENTZ SPACES

RENÉ ERLÍN CASTILLO AND HÉCTOR CAMILO CHAPARRO

Abstract. The boundedness, compactness, closed range and invertibility of the weighted composition operator on two-dimensional Lorentz spaces are characterized.

Mathematics subject classification (2010): Primary 47B33, 47B38, Secondary 46E30.

Keywords and phrases: Multiplication operator, composition operator, multidimensional rearrangement, Lorentz spaces.

REFERENCES

- [1] M. B. ABRAHAMESE, *Lecture notes in Math, Multiplication operators*, vol. **693**, Springer Verlag, New York, 1978.
- [2] M. A. ARIÑO AND B. MUCKENHOUPT, *Maximal functions on classical Lorentz spaces and Hardy's inequality with weights for nonincreasing functions*, Transactions of the American Mathematical Society **320**, 2 (1990), 727–735.
- [3] S. C. ARORA, G. DATT, AND S. VERMA, *Multiplication operators on Lorentz spaces*, Indian Journal of Mathematics **48**, 3 (2006), 317–329.
- [4] S. C. ARORA, G. DATT, AND S. VERMA, *Composition operators on Lorentz spaces*, Bulletin of the Australian Mathematical Society **76**, 2 (2007), 205–214.
- [5] A. AXLER, *Multiplication operators on Bergman space*, Reine Angew Math **33**, 2 (1982), 26–44.
- [6] S. BARZA, *Weighted multidimensional integral inequalities and applications*, Ph. D. thesis, Luleå University of Technology, 1999.
- [7] S. BARZA, L. E. PERSSON, AND J. SORIA, *Sharp weighted multidimensional integral inequalities for monotone functions*, Mathematische Nachrichten **210**, 1 (2000), 43–58.
- [8] S. BARZA, L. E. PERSSON, AND J. SORIA, *Multidimensional rearrangement and Lorentz spaces*, Acta Mathematica Hungarica **104**, 3 (2004), 203–224.
- [9] S. BARZA, L. E. PERSSON, AND V. STEPANOV, *On weighted multidimensional embeddings for monotone functions*, Mathematica Scandinavica **88**, 2 (2001), 303–319.
- [10] C. BENNETT AND R. SHARPLEY, *Interpolation of operators*, vol. **129**, Academic Press Inc, New York, 1988.
- [11] A. P. BLOZINSKI, *Multivariate rearrangements and Banach function spaces with mixed norms*, Transactions of the American Mathematical Society **263**, 1 (1981), 149–167.
- [12] M. CARRO, L. PICK, J. SORIA, AND V. D. STEPANOV, *On embeddings between classical Lorentz spaces*, Mathematical Inequalities and Applications **4** (2001), 397–428.
- [13] M. CARRO AND J. SORIA, *Weighted Lorentz spaces and the Hardy operator*, Journal of functional analysis **112**, 2 (1993), 480–494.
- [14] R. E. CASTILLO, H. C. CHAPARRO, AND J. C. RAMOS FERNÁNDEZ, *Orlicz-Lorentz Spaces and their Composition Operators*, Proyecciones (Antofagasta) **34**, 1 (2015), 85–105.
- [15] R. E. CASTILLO, H. C. CHAPARRO, AND J. C. RAMOS FERNÁNDEZ, *Orlicz-Lorentz Spaces and their Multiplication Operators*, Hacet. J. Math. Stat. **44**, 5 (2015), 991–1009.
- [16] R. E. CASTILLO, D. D. CLAHANE, J. FARÍAS LÓPEZ, AND J. C. RAMOS FERNÁNDEZ, *Composition operators from logarithmic Bloch spaces to weighted Bloch spaces*, Applied Mathematics and Computation **219**, 12 (2013), 6692–6706.

- [17] R. E. CASTILLO, J. C. RAMOS FERNÁNDEZ, AND E. M. ROJAS, *A New Essential Norm Estimate of Composition Operators from Weighted Bloch Space into-Bloch Spaces*, Journal of Function Spaces and Applications **2013** (2013).
- [18] R. E. CASTILLO, R. LEÓN, AND E. TROUSSELOT, *Multiplication operator on $L_{(p,q)}$ spaces*, Panamer. Math. J. **19**, 1 (2009), 37–44.
- [19] R. E. CASTILLO, F. A. VALLEJO NARVÁEZ, AND J. C. RAMOS FERNÁNDEZ, *Multiplication and Composition Operators on Weak L_p spaces*, Bulletin of the Malaysian Mathematical Sciences Society **38**, 3 (2015), 927–973.
- [20] R. E. CASTILLO AND H. RAFEIRO, *An Introductory Course in Lebesgue Spaces*, Springer International Publishing, New York, 2016.
- [21] R. E. CASTILLO, H. RAFEIRO, J. C. RAMOS FERNÁNDEZ, AND M. SALAS-BROWN, *Multiplication operator on Köthe spaces: measure of non-compactness and closed range*, Submitted (2016).
- [22] Y. CUI, H. HUDZIK, R. KUMAR, AND L. MALIGRANDA, *Composition operators in Orlicz spaces*, Journal of the Australian Mathematical Society **76**, 2 (2004), 189–206.
- [23] R. G. DOUGLAS, *Banach algebra techniques in operator theory*, vol. **179**, Springer Science & Business Media, 2012.
- [24] L. GRAFAKOS, *Classical Fourier Analysis*, second ed., vol. **249**, Springer, New York, 2008.
- [25] P. R. HALMOS, *A Hilbert space problem book*, vol. **19**, Springer Science & Business Media, 2012.
- [26] G. H. HARDY AND J. E. LITTLEWOOD, *A maximal theorem with function-theoretic applications*, Acta Mathematica **54**, 1 (1930), 81–116.
- [27] R. HUNT, *On $L(p,q)$ spaces*, L'Enseignement Math **12**, 2 (1966), 249–276.
- [28] B. S. KOMAL AND S. GUPTA, *Multiplication operators between Orlicz spaces*, Integral Equations and Operator Theory **41** (2001), 324–330.
- [29] B. S. KOMAL AND R. S. PATHANIA, *Composition operators on a space of operators*, Indian J. Math. **33** (1991), 11–17.
- [30] A. KUMAR, *Fredholm composition operators*, Proceedings of the American Mathematical Society **79**, 2 (1980), 233–236.
- [31] E. H. LIEB AND M. LOSS, *Analysis, volume 14 of graduate studies in mathematics*, American Mathematical Society, Providence, RI, **4** (2001).
- [32] G. G. LORENTZ, *Some new function spaces*, Ann. Math. **51**, 1 (1950), 37–55.
- [33] G. G. LORENTZ, *On the theory of spaces λ* , Pacific J. Math. **1** (1951), 411–429.
- [34] E. SAWYER, *Boundedness of classical operators on classical Lorentz spaces*, Studia Mathematica **96**, 2 (1990), 145–158.
- [35] R. K. SINGH AND A. KUMAR, *Multiplication and composition operators with closed ranges*, Bull. Aust. Math. Soc. **16** (1977), 247–252.
- [36] V. D. STEPANOV, *The weighted Hardy's inequality for nonincreasing functions*, Transactions of the American Mathematical Society **338**, 1 (1993), 173–186.
- [37] H. TAKAGI, *Fredholm weighted composition operators*, Integral Equations and Operator Theory **16** (1993).
- [38] H. TAKAGI AND K. YOKOUCHI, *Multiplication and Composition Operators between Two L_p -Spaces*, Function Spaces: Proceedings of the Third Conference on Function Spaces, May 19–23, 1998, Southern Illinois University at Edwardsville, vol. 232, American Mathematical Soc., 1999, p. 321.