

PATH CONNECTEDNESS OF VOLTERRA TYPE INTEGRAL OPERATORS ON BERGMAN AND DIRICHLET TYPE SPACES

CUI WANG

Abstract. Let $V(A^p, A^p)$ be the class of all bounded Volterra type integral operators acting on Bergman spaces. The paper studies the topological structure of $V(A^p, A^p)$. We obtained that it has the same (path) connected components, while it has no isolated point and no essentially isolated Volterra type integral operator. The same is true for Dirichlet type spaces.

Mathematics subject classification (2020): 30B40, 30D10.

Keywords and phrases: Path connected component, Volterra type integral, isolated, topological structures.

REFERENCES

- [1] R. AULASKARI, D. STEGENGA, AND J. XIAO, *Some subclasses of BMOA and their characterization in terms of Carleson measures*, Rocky Mountain J. Math. **26** (1996), 485–506.
- [2] K. ATTELE, *Interpolating sequences for the derivatives of Bloch functions*, Glasgow Math. J. **34** (1992) 35–41.
- [3] A. ALEMAN, AND A. G. SISKAKIS, *Integration operators on Bergman spaces*, Indiana Univ. Math. J. **46** (1997), no. 2, 337–356.
- [4] L. CARLESON, *An interpolation problem for bounded analytic functions*, Amer. J. Math. **80** (1958), 921–930.
- [5] L. CARLESON, *Interpolations by bounded analytic functions and the corona problem*, Ann. of Math. (2) **76** (1962), 547–559.
- [6] P. L. DUREN, *Extension of a Theorem of Carleson*, Bull. Amer. Math. Soc. **75** (1969), 143–146.
- [7] P. L. DUREN AND A. SCHUSTER, *Bergman Spaces*, Math. Surveys Monogr. vol. **100**, Amer. Math. Soc. Providence, RI (2014).
- [8] T. M. FLETT, *The dual of an inequality of Hardy and Littlewood and some related inequalities*, J. Math. Anal. Appl. **38** (1972), 746–765.
- [9] J. GARNETT, *Bounded analytic functions*, Academic Press, New York, 1981.
- [10] P. GALANOPoulos, D. GIRELA, J. PELAEZ, *Multipliers and integration operators on Dirichlet spaces*, Trans. Amer. Math. Soc. **363** (2011), no. 4, 1855–1886.
- [11] D. GIRELA, J. PELAEZ, *Carleson measures, multipliers and integration operators for spaces of Dirichlet type*, J. Funct. Anal. **241** (2006), no. 1, 334–358.
- [12] G. H. HARDY AND J. E. LITTLEWOOD, *Some more theorems concerning Fourier series and Fourier power series*, Duke Math. J. **2** (1936), 354–382.
- [13] H. HEDENMALM, B. KORENBLUM, AND K. ZHU, *Theory of Bergman Spaces*, Grad. Texts in Math. vol. **199**, Springer, New York (2000).
- [14] Y. HUANG, *Functional Analysis: An Introduction*, Science Press (2009).
- [15] R. JOUNI, *Integration operator acting on Hardy and Weighted Bergman spaces*, Bull. Austral. Math. Soc. vol. **75** (2007), 431–446.
- [16] D. H. LUECKING, *A new proof of an inequality of Littlewood and Paley*, Proc Amer. Math. Soc. **103** (1988), 887–893.
- [17] T. MENGESTIE, *Path connected components of the space of Volterra-type integral operators*, Arch. Math. **111** (2018), 389–398.

- [18] T. MENGESTIE AND M. WORKU, *Topological structures of generalized Volterra-type integral operators*, *Mediterr. J. Math.* **15** (2018), no. 2, Paper No. 42, 16 pp.
- [19] S. MIIHKINEN, J. PAU, A. PERÄLÄ, AND M. WANG, *Volterra type integration operators from Bergman spaces to Hardy spaces*, *J. Funct. Anal.* (2020), 108564, 32 pp.
- [20] CH. POMMERENKE, *Schlichte Funktionen und analytische Funktionen von beschränkter mittlerer Oszillation*, (German) *Comment. Math. Helv.* **52** (1977), no. 4, 591–602.
- [21] R. QIAN, N. HU, *Embedding Dirichlet-Morrey Spaces \mathcal{D}_p^λ into Tent Spaces and Volterra Integral Operator*, *Iran. J. Sci. Technol. Trans. Sci.* (2021) **45**: 1735–1741.
- [22] M. TJANI, *Distance of a Bloch function to the little Bloch space*, *Bull. Austral. Math. Soc.* **74** (2006) 101–119.
- [23] S. A. VINOGRADOV, *Multiplication and division in the space of analytic functions with an area-integrable derivative, and in some related spaces*, *Issled. po Linein. Oper. i Teor. Funktsii.* **23** (1995), 45–77. Translation in *J. Math. Sci. (New York)* 87 (1997), 3806–3827.
- [24] Z. WU, *Carleson measures and multipliers for Dirichlet spaces*, *J. Punc. Anal.* **169** (1999), 148–163.
- [25] R. ZHAO, *On a general family of function spaces*, *Ann. Acad. Sci. Fenn. Math. Diss.* **105**, 56 (1996).
- [26] K. ZHU, *Operator Theory in Function Spaces*, Second Edition, Mathematical Surveys and Monographs, **138**, Amer. Math. Soc, Providence (2007).