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Multi-Dimensional Generalized Integral Transform in the Weighted Spaces of Summable Functions

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Abstract

In this paper, we study a multi-dimensional generalized integral transformation. The functional and compositional properties of the integral transformation in spaces of summable functions are investigated. The scheme of study is similar to the process of constructing the theory of the H-transformation, in which the central place is given to the questions of bounded and one-to-one action of the corresponding integral operator in spaces of integrable functions with weight concentrated at zero and at infinity. Theory of the considered integral transformation in weighted spaces of summable functions is constructed.

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REFERENCES

1. S. G. Samko, A. A. Kilbas, and O. I. Marichev, *Fractional Integrals and Derivatives: Theory and Applications* (Gordon and Breach Science, London, 1993).

[MATH Google Scholar](#)

2. A. A. Kilbas, H. M. Srivastava, and J. J. Trujillo, *Theory and Applications of Fractional Differential Equations* (Elsevier, Amsterdam, 2006).

MATH Google Scholar

3. S. M. Sitnik and O. V. Skoromnik, “One-dimensional and multi-dimensional integral transforms of Buschman–Erdelyi type with Legendre Functions in kernels,” in *Transmutation Operators and Applications. Trends in Mathematics* (2020), pp. 293–319.

MATH Google Scholar

4. V. V. Katrakhov and S. M. Sitnik, “A boundary-value problem for the steady-state Schrodinger equation with a singular potential,” *Sov. Math. Dokl.* **30**, 468–470 (1984).

MATH Google Scholar

5. S. M. Sitnik, “Factorization and estimates of the norms of Buschman–Erdelyi operators in weighted Lebesgue spaces,” *Sov. Math. Dokl.* **44**, 641–646 (1992).

MATH Google Scholar

6. V. V. Katrakhov and S. M. Sitnik, “Composition method for constructing BB-elliptic, BB-hyperbolic, and BB-parabolic transformation operators,” *Russ. Acad. Sci., Dokl. Math.* **50**, 70–77 (1995).

MathSciNet MATH Google Scholar

7. S. M. Sitnik, “A short survey of recent results on Buschman–Erdelyi transmutations,” *J. Inequal. Spec. Funct.* **8**, 140–157 (2017).

MathSciNet Google Scholar

8. O. V. Skoromnik, *Integral Transforms with Gauss and Legendre Functions as Kernels and Integral Equations of the First Kind* (Polotsk Gos. Univ., Novopolotsk, Belorussia, 2019) [in Russian].

Google Scholar

9. V. V. Katrakhov and S. M. Sitnik, “The transmutation method and boundary-value problems for singular elliptic equations,” *Sovrem. Mat. Fundam. Napravl.* **64**, 211–426 (2018).

MathSciNet Google Scholar

10. E. L. Shishkina and S. M. Sitnik, *Transmutations, Singular and Fractional Differential Equations with Applications to Mathematical Physics* (Elsevier, Amsterdam, 2020).

MATH Google Scholar

11. S. M. Sitnik and E. L. Shishkina, *Transmutation Method for Differential Equations with Bessel Operators* (Fizmatlit, Moscow, 2019) [in Russian].

Google Scholar

12. V. V. Kravchenko and S. M. Sitnik, *Transmutation Operators and Applications, Trends in Mathematics* (Birkhauser, Springer Nature, Switzerland AG, Basel, 2020).
13. A. Fitouhi, I. Jebabli, E. L. Shishkina, and S. M. Sitnik, “Applications of integral transforms composition method to wave-type singular differential equations and index shift transmutations. Electron,” *J. Differ. Equat.* **2018** (130), 1–27 (2018).

MATH Google Scholar

14. Vu Kim Tuan, O. I. Marichev, and S. B. Yakubovich, “On a boundary-value problem for elliptic equations of the second order at the sphere domain,” *Dokl. Akad. Nauk SSSR* **286**, 786–790 (1986).

MathSciNet Google Scholar

15. O. I. Marichev, *Method Evaluation of Integrals of Special Functions (Theory and Formulas Tables)* (Nauka Tekhnika, Minsk, 1978) [in Russian].

Google Scholar

16. A. A. Kilbas and M. Saigo, *H-Transforms. Theory and Applications* (Chapman and Hall, Boca Raton, 2004).

Book Google Scholar

17. Yu. A. Brychkov, H.-Y. Glaeske, A. P. Prudnikov, and Vu Kim Tuan, *Multidimensional Integral Transformations* (Gordon and Breach, Philadelphia, 1992).
18. S. M. Nikolski, *Approximation of Functions of Many Variables and Embedding Theorems* (Nauka, Moscow, 1975) [in Russian].

Book Google Scholar

19. P. G. Rooney, "On integral transformations with G-function kernels," Proc. R. Soc. Edinburgh, Sect. A **93**, 265–297 (1982–1983).
20. P. G. Rooney, "On the range of the integral transformation," Canad. Math. Bul. **37**, 545–548 (1994).

[MathSciNet Article](#) [Google Scholar](#)

21. P. G. Rooney, "On the representation of functions by the Hankel and some related transformations," Proc. R. Soc. Edinburgh, Sect. A **125**, 449–463 (1995).
22. S. M. Sitnik, "Refinements and generalizations of classical inequalities," Issled. Mat. Anal., Ser.: Mat. Forum **3**, 221–266 (2009).

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