RESEARCH MONOGRAPH

The Kontorovich - Lebedev Integrals and Their Applications

(approx. 150 pages)

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Summary:

The object of this book is to give an introduction and elements of the theory of the so-called Kontorovich-Lebedev integrals, which are associated with special functions of hypergeometric type. In particular, our attention is given to the original Kontorovich-Lebedev transformation with the Macdonald function as the kernel introduced in 1938 by M.I. Kontorovich and N.N. Lebedev in connection with finding solutions of problems in diffraction theory and related topics. Some recent results of mapping and inversion properties of the Kontorovich-Lebedev transform are presented by the author. This transformation depends also upon a parameter (index) of the Macdonald function and forms a special class of integrals and transforms of non-convolution type.

The aim of the book is to exhibit different properties and methods of calculations of such integrals and transforms. The Kontorovich- Lebedev transformation is the basic in the class of the so-called index transforms. The book presents various relationships in L_p spaces of these integrals and transforms with classical Fourier and Mellin integrals, convolution transforms. As a variety of applications other related transforms and integrals are considered. For instance, elements of theory of the Mehler-Fock transform, the Olevskii transform, the Lebedev-Skalskaya transforms, the transforms with Whittaker and Lommel functions of Titchmarsh type are discussed. An attempt is taken to give correspondent convolution constructions and study integral equations with the kernel functions mentioned above.

The reader requires only a general knowledge of analysis and be presumably familiar with the elements of the theory of the Fourier and Mellin transforms and special functions. The book may be read as a useful addition to the existing literature on integral transformations and related topics. Some of principal titles on these matters are listed below. The book has been written as to be self-contained, and includes list of symbols with definitions and indices.

Audience: This work will be of interest to researches and Ph.D. students in the mathematical and physical sciences, whose work involves integral transforms and special functions.

Contents: Preface; Preliminaries; Spaces L_p; Hypergeometric Type Special Functions; Fourier, Laplace and Mellin Transforms; Mellin Convolution Type Integral Transforms; Kontorovich-Lebedev Integrals and Transform in L_1 and L_2; K-L Summability of Integrals; Double Integrals by Index and Variables of Bessel Functions; the Mehler-Fock Transform; The Kontorovich- Lebedev Transform of Arbitrary Index; The Olevskii Transform; The Lebedev-Skalskaya Transforms; Integrals with the Nicholson Kernels; Transforms of Titchmarsh Type with involving Lommel Functions; Convolution of the Kontorovich- Lebedev Transform and

Other Constructions; Some Integral Equations of second Kind; Multidimensional Kontorovich-Lebedev Transform.

Related Books

1. **Yakubovich S.B. and Luchko Yu.F.** *The Hypergeometric Approach to Integral Transforms and Convolutions,* Kluwer Academic Publishers. Mathematics and Its Applications. 287. Dordrecht. 1994. Holland.

2.**Yakubovich S.B.** *Index Transforms,* World Scientific Publ. Singapore. London. Hong Kong. 1996.

3.**Nguyen Thanh Hai and Yakubovich S.B.** *The Double Mellin-Barnes Type Integrals and their Applications to Convolution Theory,* World Scientific Publ. CO. LTD. Ser. of Soviet and East European Math.Vol.6. Singapore. London. Hong Kong. 1992.

4. **Titchmarsh E.C.** *Introduction to Theory of Fourier Integrals.* Oxford Univ.Press.: Oxford. 1937.

5. **Sneddon I.N.** *The Use of Integral Transforms.* New York. McGray Hill. 1972.

6. **Lebedev N.N.** *Special Functions and Their Applications.* Englewood Cliffs, N.J. 1965.

7. **Erdélyi A., Magnus W. and Oberhettinger, F.** *Tables of Integral Transforms*, McGraw-Hill, 1954.

8. **Zemanian A.H.** *Generalized Integral Transforms*, McGray Hill: New York. 1965.

9.**Yakubovich S.B.** The Kontorovich-Lebedev transform. Kluwer Encycl. of Math. 2000. Suppl. II, 293-294.

10. **Yakubovich S.B.** The Lebedev-Skalskaya transform. Kluwer Encycl. of Math. 2000. Suppl. II, 304-305.

11. **Yakubovich S.B.** The Mehler-Fock transform. Kluwer Encycl. of Math. 2000. Suppl. II, 344-345.

12. **Yakubovich S.B.** The Olevskii transform. Kluwer Encycl. of Math. 2000. Suppl. II, 370-371.

13. **Yakubovich S.B.** Index transforms. Kluwer Encycl. of Math. 2000. Suppl. II, 271-272.

14. **Yakubovich S.B.** Book review: **A.I.Zayed**, Function and Generalized Function Transformations, CRC Press, Boca Raton, New York, London, Tokyo. 1996. Journal of Approx. Theory. 1997. **90**, 3, 462-463.

Author Summary

Semyon Yakubovich is Visiting Associate Professor in mathematics at the University of Porto. He obtained his M.Sc., Ph.D. and Dr.Sc. degrees at the Belarusian State University, (Minsk, Belarus). He is an author more than 100 papers and three books on the theory of integral transforms and special functions.