

INTEGRAL REPRESENTATION OF SCHLÖMILCH SERIES

DRAGANA JANKOV AND TIBOR K. POGÁNY

Abstract. Certain integral representations are derived for the Schlömilch series of Bessel functions of the first kind J_ν , using newly derived integral representation of first kind Kapteyn–type series.

Mathematics subject classification (2010): Primary: 40C10, 33C10.

Keywords and phrases: Schlömilch series, Kapteyn series, Bessel functions of the first and second kind, nonhomogeneous Bessel differential equation, Dirichlet series, Laplace integral expression of Dirichlet series.

REFERENCES

- [1] Á. BARICZ, D. JANKOV, T. K. POGÁNY, *Integral representation of first kind Kapteyn series*, J. Math. Phys. **52**, 4 (2011), 043518-1-043518-7.
- [2] V. F. BONDARENKO, *Efficient summation of Schlömilch series of cylindrical functions*, Comput. Math. Math. Phys. **31**, 7 (1991), 101–104 (1992).
- [3] C. V. COATES, *Bessel's functions of the Second order*, Quarterly Journal **XXI** (1886), 183–192.
- [4] L. N. G. FILON, *On the expansion of polynomials in series of functions*, Proc. London Math. Soc. (2) **IV** (1906), 396–430.
- [5] I. S. GRADSHTEYN, I. M. RYZHIK, *Table of Integrals, Series, and Products*, Sixth Ed., Academic Press, San Diego, CA, 2000.
- [6] J. KARAMATA, *Theory and Application of the Stieltjes Integral*, Srpska Akademija Nauka, Posebna izdanja CLIV, Matematički institut, Knjiga I, Beograd, 1949. (in Serbian)
- [7] L. LANDAU, *Monotonicity and bounds on Bessel functions*, in Proceedings of the Symposium on Mathematical Physics and Quantum Field Theory, Berkeley, California, 2000, 147–154; Electronic J. Differential Equations **4** (2002), Southwest Texas State University, San Marcos, Texas.
- [8] A. R. MILLER, *m-dimensional Schlömilch series*, Canad. Math. Bull. **38**, 3 (1995), 347–351.
- [9] N. NIELSEN, *Sur le développement de zéro en fonctions cylindriques*, Math. Ann. **LII** (1899), 582–587.
- [10] N. NIELSEN, *Flertydige Udviklinger efter Cylinderfunktioner*, Nyt Tidsskrift **X B** (1899), 73–81.
- [11] N. NIELSEN, *Note sur les développements schloemilchiens en série de fonctions cylindriques*, Oversigt K. Danske Videnskabernes Selskabs (1899), 661–665.
- [12] N. NIELSEN, *Note supplémentaire relative aux développements schloemilchiens en série de fonctions cylindriques*, Oversigt K. Danske Videnskabernes Selskabs (1900), 55–60.
- [13] N. NIELSEN, *Sur une classe de séries infinies analogues à celles de Schlömilch selon les fonctions cylindriques*, Ann. di Mat. (3) **VI** (1901), 301–329.
- [14] N. NIELSEN, *Recherches sur une classe de séries infinies analogue à celle de M. W. Kapteyn*, Oversigt K. Danske Videnskabernes Selskabs (1901), 127–146.
- [15] N. NIELSEN, *Handbuch der Theorie der Cylinderfunktionen*, Leipzig, 1904.
- [16] T. K. POGÁNY, E. SÜLI, *Integral representation for Neumann series of Bessel functions*, Proc. Amer. Math. Soc. **137**, 7 (2009), 2363–2368.
- [17] J. W. S. RAYLEIGH, *On a Physical Interpretation of Schlömilch's Theorem in Bessel's Functions*, Phil. Mag. **6 XXI** (1911), 567–571.
- [18] O. X. SCHLÖMILCH, *Note sur la variation des constantes arbitraires d'une intégrale définie*, Journal für Math. **XXXIII** (1846), 268–280.

- [19] V. TWERSKY, *Elementary function representations of Schlömilch series*, Arch. Rational Mech. Anal. **8** (1961), 323–332.
- [20] G. N. WATSON, *A Treatise on the Theory of Bessel Functions*, Cambridge University Press, Cambridge, 1922.