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ANALYTICAL SOLUTION FOR THE GENERALIZED TIME–FRACTIONAL TELEGRAPH EQUATION

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Abstract. We discuss and derive the analytical solution for the generalized time-fractional telegraph equation. These problems are solved by taking the Laplace and Fourier transforms in variable t and x respectively. Here we use Green function also to derive the solution of the given differential equation.

Mathematics subject classification (2010): Primary 26A33, 33C20, 33E12; secondary 47B38, 47G10.
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REFERENCES

[1] I. PODLUBNY, *Fractional Differential Equations: An Introduction to Fractional Derivatives, Fractional Differential Equations, to Methods of Their Solution and Some of Their Applications*, Mathematics in Science and Engineering, vol. **198**, Academic Press, San Diego, Calif, USA, 1999.

[2] F. MAINARDI, *Fractional calculus: some basic problems in continuum and statistical mechanics*, in *Fractals and Fractional Calculus in Continuum Mechanics*, A. Carpinteri and F. Mainardi, Eds., CISM Courses and Lectures, vol. **378**, pp. 291–348, Springer, Vienna, Austria, 1997.

[3] R. C. CASCAVAL, E. C. ECKSTEIN, C. L. FROTA, AND J. A. GOLDSTEIN, *Fractional telegraph equations*, Journal of Mathematical Analysis and Applications **276**, 1 (2002), 145–159.

[4] E. ORSINGHER AND L. BEGHIN, *Time-fractional telegraph equations and telegraph processes with brownian time*, Probability Theory and Related Fields **128**, 1 (2004), 141–160.

[5] J. CHEN, F. LIU, AND V. ANH, *Analytical solution for the time-fractional telegraph equation by the method of separating variables*, Journal of Mathematical Analysis and Applications **338**, 2 (2008), 1364–1377.

[6] E. ORSINGHER AND X. ZHAO, *The space-fractional telegraph equation and the related fractional telegraph process*, Chinese Annals of Mathematics Series B **24**, 1 (2003), 45–56.

[7] S. MOMANI, *Analytic and approximate solutions of the space- and time-fractional telegraph equations*, Applied Mathematics and Computation **170**, 2 (2005), 1126–1134.

[8] R. FIGUEIREDO CAMARGO, A. O. CHIACCHIO, AND E. CAPELAS DE OLIVEIRA, *Differentiation to fractional orders and the fractional telegraph equation*, Journal of Mathematical Physics **49**, 3 (2008), Article ID 033505, 12 pages.

[9] F. MAINARDI, *Fractional relaxation-oscillation and fractional diffusion-wave phenomena*, Chaos, Solitons & Fractals **7**, 9 (1996), 1461–1477.

[10] R. GORENFLO, Y. LUCHKO, AND F. MAINARDI, *Wright functions as scale-invariant solutions of the diffusion-wave equation*, Journal of Computational and Applied Mathematics **118**, 1–2 (2000), 175–191.

[11] F. MAINARDI, Y. LUCHKO, AND G. PAGNINI, *The fundamental solution of the space-time fractional diffusion equation*, Fractional Calculus & Applied Analysis **4**, 2 (2001), 153–192.

[12] W. R. SCHNEIDER AND W. WYSS, *Fractional diffusion and wave equations*, Journal of Mathematical Physics **30**, 1 (1989), 134–144.

[13] F. HUANG, *Analytical Solution for the Time-Fractional Telegraph Equation*, Hindawi Publishing Corporation, Journal of Applied Mathematics Vol. **2009**, Article ID 890158, 9 pages.

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[14] MOUSTAFA EL-SHAHED, *MHD of a Fractional Viscoelasticity Fluid in a CircularTube*, Mechanics Research Communications **33** (2006), 261–268.