Approximation Theory and Special Functions
ATSF 2026 Conference - 9th Series
September 2-5, 2026, Ankara - Türkiye

Laplace-Hankel Transforms for Fractional Differential Equations

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Abstract

This work presents a study of the Laplace-Hankel transform method for solving fractional differential equations. By combining the Laplace transform in time and the Hankel transform in radial space, fractional partial differential equations can be reduced to simpler algebraic forms in the transform domain. This approach is particularly useful for problems with radial symmetry and memory effects. Analytical solutions are obtained in terms of Mittag-Leffler functions for representative fractional diffusion models. The results show that the Laplace–Hankel transform is an efficient and powerful tool for handling fractional differential equations arising in applied mathematics and physics.

Keywords: Fractional differential equations, Laplace transform, Hankel transform, Laplace-Hankel transform, fractional calculus, Mittag-Leffler function, radial symmetry.

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