

Spectral and Pseudo-Spectral Methods for Space-Time Distributed Fractional PDEs

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Distributed-order fractional PDEs are tractable mathematical models for complex multi-scale anomalous transport, where derivative orders are distributed over a range of values. We develop a fast and stable Petrov-Galerkin and pseudo-spectral methods for such models. By defining the proper underlying distributed Sobolev spaces and their equivalent norms, we prove the well-posedness of the weak formulations, and thereby carry out the corresponding stability and error analysis. We finally provide several numerical simulations to study the performance and convergence of the proposed schemes.