# A numerical procedure for fractional-time-space differential equations with the spectral fractional Laplacian

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We present a computationally effective procedure for numerically solving fractional-time-space differential equations with the spectral fractional Laplacian [1]. A truncated spectral representation of the solution in terms of the eigenfunctions of the usual integer-order Laplacian is considered. Time-dependent coefficients in this representation, which are solutions to some linear fractional differential equations, are evaluated by means of a generalized exponential time-differencing method [2], which presents some advantages in terms of accuracy and computational effectiveness. Rigorous a-priori error estimates are derived, and they are verified by means of some numerical experiments.

## References

[1] F.V. Difonzo, R. Garrappa, *A numerical procedure for fractional-time-space differential equations with the spectral fractional Laplacian*, accepted for publication in Springer INdAM Series.

[2] R. Garrappa, M. Popolizio, *Generalized exponential time differencing methods for fractional order problems*, Computer & Mathematics with Applications, **62**(3) (2011), 876–890.