

Solution of a Fractional Reaction-Diffusion Equation with Linear Reaction Kinetics

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Since the fractional diffusion equation there has been a growing number of models incorporating fractional spatial or temporal derivatives.

However the numerical simulation of models involving Riemann-Liouville temporal derivatives is complicated by the high storage and computational requirements to evaluate the fractional derivatives.

For long simulations these requirements may be prohibitive especially if a full history is maintained. In such circumstances an analytical solution would be of great value but unfortunately only the simplest models can be solved. In this talk I shall discuss a method of solving fractional reaction-diffusion equations in the special case of linear reaction kinetics. I will give examples of a linearised fractional cable equation in one dimension and a fractional dispersal equation in axisymmetric polar coordinates. The resulting solutions in the infinite and finite domains involve Fox functions and Mittag-Leffler functions respectively. The solution of linearised models could be used to gauge the early time behaviour of the simulations and their numerical accuracy.