

# Séminaire de mathématiques et leurs applications

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**Title:** A finite difference scheme for an initial-boundary value problem with a Caputo fractional derivative.

**Abstract:** A reaction-diffusion problem with a Caputo time derivative of order  $\alpha \in (0, 1)$  is considered. The behaviour of the solution is discussed and it is shown that in general the solution has a weak singularity near the initial time  $t = 0$ . Taking into account this singular behaviour and the memory effect of the fractional derivative, a finite difference scheme is defined and its convergence in the discrete maximum norm is analysed. The theoretical error estimates are sharp and they indicate that a graded mesh has to be used to obtain optimal numerical results. Some related results to the convergence of the method away  $t = 0$  are also discussed. Numerical results are presented that confirm the theoretical error estimates.