

Finite difference method for a fractional porous medium equation

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Abstract. We formulate a numerical method to solve the porous medium type equation with fractional diffusion

$$\frac{\partial u}{\partial t} + (-\Delta)^{1/2}(u^m) = 0.$$

The problem is posed in $x \in \mathbb{R}^N$, $m \geq 1$ and with nonnegative initial data. The fractional Laplacian is implemented via the so-called Caffarelli-Silvestre extension. We prove existence and uniqueness of the solution of this method and also the convergence to the theoretical solution of the equation. We run numerical experiments on typical initial data.

References

- [1] F. del Teso. Finite difference method for a fractional porous medium equation. <http://arxiv.org/pdf/1301.4349.pdf>