

DISCRETE MOLLIFICATION FOR INVERSE PROBLEMS BASED ON TIME-FRACTIONAL DIFFERENTIAL EQUATIONS

CARLOS D. ACOSTA, MANUEL D. ECHEVERRY, ESTEFANÍA J. GUEVARA, CARLOS E. MEJÍA,
AND ALEJANDRO PIEDRAHITA

ABSTRACT. The method of discrete mollification, which is based on a convolution with a truncated gaussian kernel, has been implemented as a regularization tool for inverse problems and as an acceleration mechanism for explicit schemes. The method is particularly useful in combination with space-marching finite difference schemes for the numerical solution of inverse problems related to heat equations. In this talk we present an update on the use of mollification for the numerical solution of some inverse problems associated to one dimensional time-fractional differential equations. The main features are: The fractional derivatives are interpreted in the sense of Caputo, the only available data are noisy and the solution process includes automatic selection of the involved regularization parameters. Error estimates for the numerical solution of the mollified problem and numerical examples are provided.

Keywords: Discrete mollification, time-fractional equation, inverse problem.

Mathematics Subject Classifications (2010): 35R11, 65M06, 65M32.

REFERENCES

- [1] C.D. Acosta, P.A. Amador y C.E. Mejía. Stability analysis of a finite difference scheme for a nonlinear time fractional convection diffusion equation. In *Analysis, modelling, optimization and numerical techniques*, G. Olivar and O. Vasilieva (eds.) Springer Proceedings in Mathematics & Statistics 121, (2015) 139 – 150.
- [2] E.J. Guevara. Problemas inversos asociados a ecuaciones con derivadas fraccionarias. Tesis de Maestría en Matemática Aplicada (en preparación). Universidad Nacional de Colombia, Manizales, 2015.
- [3] D.A. Murio and C.E. Mejía. Generalized time fractional IHCP with Caputo Fractional Derivatives. *Journal of Physics: Conference Series*, 135 (2008) 012074.
- [4] D.A. Murio and C.E. Mejía. Source Terms Identification for Time Fractional Diffusion Equation. *Revista Colombiana de Matemáticas*, Vol. 42 (2008)1, pp. 25–46.

DEPARTAMENTO DE MATEMÁTICAS Y ESTADÍSTICA, UNIVERSIDAD NACIONAL DE COLOMBIA, MANIZALES
E-mail address: cdacostam@unal.edu.co

ESCUELA DE MATEMÁTICAS, UNIVERSIDAD NACIONAL DE COLOMBIA, MEDELLÍN
E-mail address: mdecheve@unal.edu.co

DEPARTAMENTO DE MATEMÁTICAS Y ESTADÍSTICA, UNIVERSIDAD NACIONAL DE COLOMBIA, MANIZALES
E-mail address: ejguevarab@unal.edu.co

ESCUELA DE MATEMÁTICAS, UNIVERSIDAD NACIONAL DE COLOMBIA, MEDELLÍN
E-mail address: cemejia@unal.edu.co

ESCUELA DE MATEMÁTICAS, UNIVERSIDAD NACIONAL DE COLOMBIA, MEDELLÍN
E-mail address: apiedrahita@unal.edu.co