

# Accepted Manuscript

On fractional backward differential formulas for fractional delay differential equations with periodic and anti-periodic conditions

M. Saedshoar Heris, M. Javidi

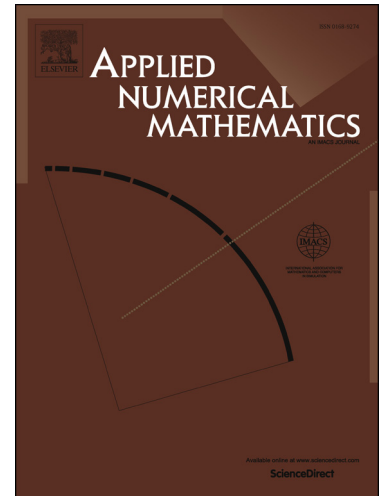
PII: S0168-9274(17)30067-3  
DOI: <http://dx.doi.org/10.1016/j.apnum.2017.03.006>  
Reference: APNUM 3184

To appear in: *Applied Numerical Mathematics*

Received date: 30 July 2016  
Revised date: 13 February 2017  
Accepted date: 13 March 2017

Please cite this article in press as: M. Saedshoar Heris, M. Javidi, On fractional backward differential formulas for fractional delay differential equations with periodic and anti-periodic conditions, *Appl. Numer. Math.* (2017), <http://dx.doi.org/10.1016/j.apnum.2017.03.006>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



# On fractional backward differential formulas for fractional delay differential equations with periodic and anti-periodic conditions

M. Saedshoar Heris, M. Javidi\*

*Department of Applied Mathematics, University of Tabriz, Tabriz, Iran*

---

## Abstract

In this paper, fractional backward differential formulas (FBDF) are presented for the numerical solution of fractional delay differential equations (FDDEs) of the form  $\lambda_{n0}^C D_t^{\alpha_n} y(t) + \lambda_{n-10}^C D_t^{\alpha_{n-1}} y(t) + \cdots + \lambda_{10}^C D_t^{\alpha_1} y(t) + \lambda_{n+1} y(t - \tau) = f(t)$ ,  $t \in [0, T]$ , where  $\lambda_i \in \mathbb{R}$  ( $i = 1, \dots, n+1$ ),  $\lambda_{n+1} \neq 0$ ,  $0 \leq \alpha_1 < \alpha_2 < \cdots < \alpha_n < 1$ ,  $T > 0$ , in Caputo sense. Our investigation is focused on stability properties of the numerical methods and we determine stability regions for the FDDEs. Also we find the Green's functions for this equation corresponding to periodic/ anti-periodic conditions in terms of the functions of Mittag Leffler type. Numerical tests are presented to confirm the strength of the approach under investigation.

*Keywords:* Fractional backward differential formulas; linear delay differential equations; stability;

*2010 MSC:* 34A30, 65L06, 65L20

---

## 1. Introduction

Fractional differential equations arise in many scientific disciplines as the mathematical models of systems and processes in the fields of physics, polymer rheology, regular variation in thermodynamics, biophysics, blood flow phe-

---

\*Corresponding author

*Email address:* mo\_javidi@tabrizu.ac.ir (M. Javidi)

Download English Version:

<https://daneshyari.com/en/article/5776629>

Download Persian Version:

<https://daneshyari.com/article/5776629>

[Daneshyari.com](https://daneshyari.com)