MONOTONE ITERATIVE TECHNIQUE WITH INITIAL TIME DIFFERENCE FOR FRACTIONAL DIFFERENTIAL EQUATIONS

Coşkun Yakar*† and Ali Yakar*

Abstract

In this paper, we employ the monotone iterative technique for fractional differential equations of Riemann-Liouville type by choosing upper and lower solutions that start at different initial times.

Communicated by Ağacık Zafer

1. Introduction

The concept of derivative of an arbitrary order or fractional order arose 300 years ago with L'Hospital's query to Leibnitz, and his reply to L'Hospital, in which the meaning of the derivative of order one-half (1/2) was discussed. Since that time the fractional calculus has drawn the attention of many famous mathematicians. By the end of the 19th century, due to the works of Liouville, Grünwald, Letnikov and Riemann, the theory of the calculus of arbitrary order was more or less developed, mainly as a pure theoretical field of mathematics useful only for mathematicians.

It has been shown recently that fractional differential equations provide an excellent model for real world problems in a variety of disciplines. This is the main advantage of fractional derivatives in comparison with conventional integer order models. There has been a growing interest in this new area to study, the concept of fractional differential equations and fractional dynamic systems [2, 5, 7, 10, 11].

The monotone iterative technique [4], coupled with the method of upper and lower solutions, offers monotone sequences that converge uniformly and monotonically to the

---

*Department of Mathematics, Gebze Institute of Technology, Gebze-Kocaeli 141-41400, Turkey. E-mail: (C. Yakar) cyakar@gyte.edu.tr (A. Yakar) ayakar@gyte.edu.tr

†Corresponding Author.