Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **27 (2020)** 235-244
 http://www.watam.org

ON STABILITY OF GENERALIZED CAUCHY-TYPE PROBLEM

Sandeep P Bhairat

Institute of Chemical Technology, Mumbai
Marathwada Campus, Jalna–431 213 (M.S) India.

Abstract. In this paper, we study the stability of solution of initial value problem for fractional differential equation involving generalized Katugampola derivative. Pachpatte inequality is used as handy tool to obtain our result.

Keywords. Fractional differential equations, Initial value problem, Stability of solutions.

AMS (MOS) subject classification: 26A33, 34A08, 34D23.

1 Introduction

Nowadays, the subject of fractional calculus attracted great attention of many researchers and emerged as an advancement in applied mathematics. In last three decades, fractional calculus found useful for capturing naturally arising complex phenomena. The theory of arbitrary order achieved a new height in the description of properties of viscoelastic materials and memory mechanism [6, 11]. In recent years there has been a considerable interest in qualitative properties of fractional differential equations by using numerous operators and variety of techniques, see [1]-[5],[7, 8, 10, 13].

The aim of the present paper is to study the stability of generalised Cauchy-type problem involving generalized Katugampola derivative

$$\begin{cases} {}^{\rho}D_{a+}^{\alpha,\beta}x(t) = f(t,x(t)), & 0<\alpha<1, 0\le\beta\le 1, \rho>0, \\ \left(\frac{t^\rho-a^\rho}{\rho}\right)^{(1-\beta)(1-\alpha)} x(t)\Big|_{t=a} = b, & b\in\mathbb{R}\backslash\{0\}. \end{cases} \tag{1}$$

Clearly, the IVP (1) is equivalent to the integral equation

$$x(t) = \frac{b}{\Gamma(\gamma)}\left(\frac{t^\rho-a^\rho}{\rho}\right)^{\gamma-1} + \int_a^t s^{\rho-1}\left(\frac{t^\rho-s^\rho}{\rho}\right)^{\alpha-1}\frac{f(s,x(s))}{\Gamma(\alpha)}ds. \tag{2}$$

The remaining paper is arranged as follows: in Section 2, we recall the preliminary facts useful for further discussion. In Section 3, we state and prove our main results. Pachpatte inequality is the main ingredient.