Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **29 (2022)** 433-445
 http://www.watam.org

ON GENERALIZED CONFORMABLE CALCULUS

Sabri T.M. Thabet[1], Bashir Ahmad[2] and Ravi P. Agarwal[3]

[1]Department of Mathematics, University of Aden, Aden, Yemen

[2]Nonlinear Analysis and Applied Mathematics (NAAM)–Research Group,
Department of Mathematics, Faculty of Science, King Abdulaziz University
P.O. Box 80203, Jeddah 21589, Saudi Arabia

[3]Department of Mathematics, Texas A& M University, Kingsville,
Texas 78363-8202, USA

E-mail: th.sabri@yahoo.com or sabri.thabet.edu.r@aden-univ.net,
bashirahmad_qau@yahoo.com, Ravi.Agarwal@tamuk.edu

Abstract. We enhance the scope of conformable operators by introducing the new concept of generalized conformable differential and integral operators of arbitrary order (in short, GCD and GCI respectively). For these operators, we investigate several properties such as, commutative property, index law, Cauchy theorem, increasing and decreasing conditions, racetrack type principle, integration by parts, etc. We also introduce a new concept of generalized conformable Laplace transform and show its applications.

Keywords. Generalized conformable derivative and integral, conformable function, generalized conformable Laplace transform.

AMS (MOS) subject classification: 26A33, 34A06, 34A08.

1 Introduction

In a recent work [1], the authors introduced a new definition of fractional derivative named conformable fractional derivative (CFD), which was later studied by many authors [2, 3, 4, 5, 6, 7]. Later, Zhao and Luo [8] presented a generalized form of CFD and called it general conformable fractional derivative (GCFD). However, these derivatives are nothing to do with the fractional calculus which deals with nonlocal operators. We prefer to name these derivatives as "conformable differential (CD) operator and generalized conformable differential (GCD) operator" (without the word "fractional").

For geometric meaning, physical interpretation and the significant applications of the CD and GCD operators in engineering and sciences fields, see [9, 10, 11, 12, 13, 14]. For some results on boundary value problems involving conformable differential operators, see [15, 16, 17]. In the present article, we plan to enhance the scope of conformable operators by introducing further generalization of generalized conformable differential and integral operators