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GENERALIZED OPIAL—TYPE INEQUALITIES FOR DIFFERENTIAL AND INTEGRAL OPERATORS WITH SPECIAL KERNELS IN FRACTIONAL CALCULUS

G. Farid, J. Pečarić and Ž. Tomovski

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Abstract. In this paper we give Opial-type inequalities for two functions and multiple Opial-type inequalities by using generalized fractional differential and integral operators with special kernels. Also, we deduce some results that already have been proved in [9, 10].

1. Introduction

Mathematical inequalities which involve derivatives and integrals of functions are of great interest. Opial's inequality [14] is of great importance in mathematics with respect to applications in theory of differential equations and difference equations. Many researchers have been published its improvements and generalizations, one can see (for instance, [1, 2]) and references there in. In 1960. Opial established the following integral inequality.

Let $x(t) \in C^{(1)}[0,h]$ be such that $x(0) = x(h) = 0$, and $x(t) > 0$ in $(0,h)$. Then

$$\int_0^h |x(t)x'(t)|dt \leqslant \frac{h}{4}\int_0^h (x'(t))^2 dt, \qquad (1.1)$$

where constant $\frac{h}{4}$ is the best possible.

Agarwal and Pang [1] studied Opial-type inequalities involving ordinary derivatives and their applications in differential equations and difference equations. Iqbal et al. in [9] gave Opial-type inequalities for two functions for general kernels and provided a connection between their results and results in [6]. They presented fractional versions of Opial-type inequalities regarding fractional derivatives of Riemann-Liouville, Caputo and Canavati type.

By $C^m[a,b]$ we denote the space of all functions which have continuous derivatives up to order m, and $AC[a,b]$ is the space of all absolutely continuous functions on $[a,b]$. By $AC^m[a,b]$ we denote the space of all functions $f \in C^{m-1}[a,b]$ with $f^{(m-1)} \in$

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