

A MULTIPLE OPIAL TYPE INEQUALITY FOR THE RIEMANN-LIOUVILLE FRACTIONAL DERIVATIVES

M. ANDRIĆ, J. PEČARIĆ AND I. PERIĆ

Abstract. The aim of this paper is to prove a multiple Opial type inequality for RL fractional derivatives which is proved for two factors and ordinary derivatives by Fink in [6]. Two methods are applied and a comparison of the obtained estimations is also given.

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REFERENCES

- [1] R. P. AGARWAL, P. Y. H. PANG, *Opial Inequalities with Applications in Differential and Difference Equations*, Kluwer Academic Publishers, Dordrecht, Boston, London, 1995.
- [2] G. A. ANASTASSIOU, J. J. KOLIHA, J. PEČARIĆ, *Opial inequalities for fractional derivatives*, Dynamic Systems Appl. **10** (2001), 395–406.
- [3] G. A. ANASTASSIOU, J. J. KOLIHA, J. PEČARIĆ, *Opial type L_p -inequalities for fractional derivatives*, Inter. J. Math. & Math. Sci. **31**, 2 (2002), 85–95.
- [4] M. ANDRIĆ, J. PEČARIĆ, I. PERIĆ, *Improvements of composition rule for the Canavati fractional derivatives and applications to Opial-type inequalities*, Dynamic Systems Appl. **20** (2011), 383–394.
- [5] M. ANDRIĆ, J. PEČARIĆ, I. PERIĆ, *Composition identities for the Caputo fractional derivatives and applications to Opial-type inequalities*, to appear in Math. Inequal. Appl.
- [6] A. M. FINK, *On Opial's inequality for $f^{(n)}$* , Proc. Amer. Math. Soc. **115** (1992), 177–181.
- [7] A. A. KILBAS, H. M. SRIVASTAVA, J. J. TRUJILLO, *Theory and Applications of Fractional Differential Equations*, North-Holland Mathematics Studies **204**, Elsevier, 2006.
- [8] Z. OPIAL, *Sur une inégalité*, Ann. Polon. Math. **8** (1960), 29–32.
- [9] P. Y. H. PANG, R. P. AGARWAL, *On an Opial type inequality due to Fink*, J. Math. Anal. Appl. **196**, 2 (1995), 748–753.
- [10] S. G. SAMKO, A. A. KILBAS, O. I. MARICHEV, *Fractional Integrals and Derivatives. Theory and Applications*, Gordon and Breach, Reading, 1993.
- [11] D. V. WIDDER, *The Laplace Transform*, Princeton University Press, 1941.