

## INEQUALITIES FOR FRACTIONAL DIFFERENTIAL EQUATIONS

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*Abstract.* We consider some differential inequalities involving fractional derivatives in the sense of Riemann-Liouville. Bounds for these fractional differential inequalities are found using desingularization techniques combined with some generalizations of Bihari-type inequalities. Some applications illustrating the usefulness of our results are also provided.

*Mathematics subject classification (2000):* 26D10, 26D15, 42B20.

*Keywords and phrases:* Bihari inequality, exponential decay, fractional derivative, fractional differential inequality, power type decay.

### REFERENCES

- [1] G. A. ANASTASSIOU, *Opial type inequalities involving fractional derivatives of functions*, *Nonlinear Studies*, 6:207–230, 1999.
- [2] G. A. ANASTASSIOU, J. J. KOLIHA, AND J. PECARIC, *Opial inequalities for fractional derivatives*, *Dynamic Systems and Applications*, 10:395–406, 2001.
- [3] D. BAINOV AND P. SIMEONOV, *Integral Inequalities and Applications*, volume 57, Kluwer Acad. Publishers, Dordrecht, Boston, London, 1992.
- [4] K. M. FURATI AND N. E. TATAR, *An existence result for a nonlocal fractional differential problem*, *Journal of Fractional Calculus*, 26:43–51, 2004.
- [5] K. M. FURATI AND N. E. TATAR, *Power-type estimates for a nonlinear fractional differential equation*, *Nonlinear Analysis: Theory, Methods & Applications*, 62(6):1025–1036, 2005.
- [6] K. M. FURATI AND N. E. TATAR, *Some fractional differential inequalities and their applications*, *Mathematical Inequalities and Applications*, 9(4):577–598, 2006.
- [7] K. M. FURATI AND N. TATAR, *Behaviour of solutions for a weighted Cauchy-type fractional differential problem*, *Journal of Fractional Calculus*, 28:23–42, 2005.
- [8] A. A. KILBAS, H. M. SRIVASTAVA, AND J. J. TRUJILLO, *Theory and Applications of Fractional Differential Equations*, volume 204 of *Mathematics Studies*, Elsevier, 2006.
- [9] A. A. KILBAS AND J. J. TRUJILLO, *Differential equations of fractional order: methods, results and problems, I*, *Applicable Analysis*, 78:153–192, 2001.
- [10] A. A. KILBAS AND J. J. TRUJILLO, *Differential equations of fractional order: methods, results and problems, II*, *Applicable Analysis*, 81:435–493, 2002.
- [11] B. G. PACHPATTE, *Inequalities for Differential and Integral Equations*, volume 197 of *Mathematics in Science and Engineering*, Acad. Press, San Diego-London, 1998. Edited by W. F. Ames.
- [12] I. PODLUBNY, *Fractional Differential Equations*, volume 198 of *Mathematics in Science and Engineering*, Acad. Press, 1999.
- [13] S. G. SAMKO, A. A. KILBAS, AND O. I. MARICHEV, *Fractional Integrals and Derivatives, Theory and Applications*, Gordon and Breach, Amsterdam, 1993. Engl. Trans. From the Russian 1987.