

APPLICATIONS OF REFINED HARDY-TYPE INEQUALITIES

SAJID IQBAL, JOSIP PEČARIĆ, MUHAMMAD SAMRAIZ AND NAZRA SULTANA

Abstract. This paper is to provide the broad range of Hardy-type inequalities and their refinements for linear differential operator, Widder's derivative and more generalized fractional integral operator using convex and monotone convex functions. As special cases we give results for Saigo, Riemann-Liouville and Erdélyi-Kober fractional integral operators.

Mathematics subject classification (2010): 26D15, 26D10, 26A33, 34B27.

Keywords and phrases: Inequalities, Green's function, linear differential operator, Widder's derivative, fractional integral.

REFERENCES

- [1] S. ABRAMOVICH, K. KRULIĆ, J. PEČARIĆ AND L.-E. PERSSON, *Some new refined Hardy type inequalities with general kernels and measures*, *Aequationes mathematicae* **79** (1-2) (2010), 157–172.
- [2] E. ADELEKE, A. ČIŽMEŠIJA, J. OGUNTUASE, L.-E. PERSSON AND D. POKAZ, *On a new class of Hardy-type inequalities*, *J. Inequal. Appl.*, 2012.
- [3] S. N. BERNSTEIN, *Sur les fonctions absolument monotones*, *Acta Math.* **52** (1929), 1–66.
- [4] A. ČIŽMEŠIJA, J. A. OGUNTUASE AND L.-E. PERSSON, *Multidimensional Hardy-type Inequalities via convexity*, *Bull. Austral. Math. Soc.* **77** (2008), 245–260.
- [5] A. ČIŽMEŠIJA, K. KRULIĆ, AND J. PEČARIĆ, *Some new refined Hardy-type inequalities with kernels*, *J. Math. Inequal.* **4** (4) (2010), 481–503.
- [6] A. ČIŽMEŠIJA, K. KRULIĆ, AND J. PEČARIĆ, *A new class of general refined Hardy-type inequality with kernels*, *Rad HAZU*, **17** (2013), 53–80.
- [7] L. CURIEL, L. GALUÉ, *A generalization of the integral operators involving the Gauss hypergeometric function*, *Revista Técnica de la Facultad de Ingeniería Universidad del Zulia*, **19** (1) (1996), 17–22.
- [8] N. ELEZOVIĆ, K. KRULIĆ, J. PEČARIĆ, *Bounds for Hardy type differences*, *Acta Mathematica Sinica, English Series*, **27** (4) (2011), 671–684.
- [9] S. IQBAL, G. FARID AND J. PEČARIĆ, *Hardy-type inequalities for linear differential operator and Widder's derivative*, (Submitted).
- [10] S. IQBAL, K. KRULIĆ AND J. PEČARIĆ, *On an inequality of H. G. Hardy*, *J. Inequal. Appl.*, vol. 2010. Article ID 264347, 23 pages.
- [11] S. IQBAL, K. KRULIĆ AND J. PEČARIĆ, *On an inequality for convex function with some applications on fractional derivatives and fractional integrals*, *J. Math. Inequal.* Volume 5, Number **2** (2011), 219–230.
- [12] S. IQBAL, K. KRULIĆ HIMMELREICH, J. PEČARIĆ AND DORA POKAZ, *n-Exponential Convexity of Hardy-type and Boas-type functionals*, *J. Math. Inequal.* Volume 7, Number **4** (2011).
- [13] S. KAIJSER, L. NIKOLOVA, L. E. PERSSON, AND A. WEDESTIG, *Hardy-Type Inequalities via Convexity*, *Math. Inequal. Appl.*, **8**, (2005), 403–417.
- [14] K. KRULIĆ, J. PEČARIĆ, L. E. PERSSON, *Some new Hardy type inequalities with general kernels*, *Math. Inequal. Appl.*, **12**, (2009), 473–485.
- [15] B. OPIC AND A. KUFNER, *Hardy-type inequalities*, Pitman Research Notes in Mathematics Series, Longman Scientific & Technical, Harlow, 1990.
- [16] J. E. PEČARIĆ, F. PROSCHAN, AND Y. L. TONG, *Convex functions, Partial Orderings and Statistical Applications*, Academic Press, San Diego, 1992.
- [17] D. V. WIDDER, *A Generalization of Taylor's Series*, *Transactions of AMS*, **30**, (1), (1928) 126–154.