

MULTIDIMENSIONAL HARDY-TYPE INEQUALITIES ON TIME SCALES WITH VARIABLE EXPONENTS

O. O. FABELURIN, J. A. OGUNTUASE AND L.-E. PERSSON

Abstract. A new Jensen inequality for multivariate superquadratic functions is derived and proved. The derived Jensen inequality is then employed to obtain the general Hardy-type integral inequality for superquadratic and subquadratic functions of several variables.

Mathematics subject classification (2010): 26D10, 26D20, 26E70.

Keywords and phrases: Multidimensional inequalities, Jensen's inequality, Hardy-type inequalities, time scales, superquadratic functions.

REFERENCES

- [1] R. P. AGARWAL, M. BOHNER AND N. PETERSON, *Inequalities on time scales: a survey*, Math. Inequal. Appl. 4 (2001), 535–557.
- [2] R. P. AGARWAL, D. O'REGAN AND S. H. SAKAR, *Dynamic inequalities on time scales*, Springer, Heidelberg/New York/Dordrecht/London, 2014.
- [3] R. P. AGARWAL, D. O'REGAN AND S. H. SAKAR, *Hardy type inequalities on time scales*, Springer International Publishing, Switzerland, 2016.
- [4] M. ANWAR, R. BIBI, M. BOHNER AND J. E. PEČARIĆ, *Jensen's functional on time scales for several variables*, Int. J. Anal. 2014 (2014), 14pp.
- [5] R. BIBI, M. BOHNER, J. E. PEČARIĆ AND S. VAROŠANEC, *Minkowski and Beckenbach-Dresher inequalities and functionals on time scales*, J. Math. Inequal. 7 (2013), no. 3, 299–312.
- [6] M. BOHNER AND A. PETERSON (EDS.), *Dynamic equations on time scales: An Introductin with Applications*, Birkhäuser, Boston, Massachusetts, 2001.
- [7] M. BOHNER AND A. PETERSON (EDS.), *Advances in Dynamic equations on time scales*, Birkhäuser, Boston, Massachusetts, 2003.
- [8] T. DONCHEV, A. NOSHEEN AND J. E. PEČARIĆ, *Hardy-Type inequalities on time scales via convexity in several variables*, ISRN Math. Anal. 2013 (2013), 9pp.
- [9] G. H. HARDY, *Notes on a theorem of Hilbert*, Math. Z. 6 (1920), 314–317.
- [10] G. H. HARDY, *Notes on some points in the integral calculus, LX. An inequality between integrals*, Messenger Math. 54 (1925), 150–156.
- [11] G. H. HARDY, J. E. LITTLEWOOD AND G. PÓLYA, *Inequalities*, Cambridge University Press, Cambridge, 1959.
- [12] S. HILGER, *Ein Maßkettenkalkül mit Anwendung auf Zentrumsmannigfaltigkeiten*, PhD thesis, Universität Würzburg, 1988.
- [13] S. HILGER, *Differential and difference calculus*, Nonlinear Anal., Proceedings of Second World Congress of Nonlinear Analysts, **30** (5), (1997), 2683–2694.
- [14] S. HILGER, *Analysis on measure chains-a unified approach to continuous and discrete calculus*, Results Math. **18** (1990), no. 1–2, 18–56.
- [15] A. KUFNER, L. MALIGRANDA AND L. - E. PERSSON, *The prehistory of the Hardy inequality*, Amer. Math. Monthly 113 (2006), no. 10, 715–732.
- [16] A. KUFNER, L. MALIGRANDA AND L. - E. PERSSON, *The Hardy Inequality. About its History and Some Related Results*, Vydavatelsky Servis Publishing House, Pilsen, 2007.
- [17] A. KUFNER, L. - E. PERSSON AND N. SAMKO, *Weighted Inequalities of Hardy type*, Second Edition, World Scientific Publishing Co. Inc., River Edge, New Jersey, 2017.

- [18] J. A. OGUNTUASE AND L. E. PERSSON, *Time scales Hardy-type inequalities via superquadraticity*, Ann. Funct. Anal. 5 (2014), no.2, 61–73.
- [19] P. ŘEHÁK, *Hardy inequality on time scales and its application to half-linear dynamic equations*, J. Inequal. Appl. 5 (2005), 495–507.