

INTEGRAL INEQUALITIES AND THEIR APPLICATIONS TO THE CALCULUS OF VARIATIONS ON TIME SCALES

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Abstract. We discuss the use of inequalities to obtain the solution of certain variational problems on time scales.

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REFERENCES

- [1] R. AGARWAL, M. BOHNER AND A. PETERSON, *Inequalities on time scales: a survey*, Math. Inequal. Appl., **4**, 4 (2001), 535–557.
- [2] F. M. ATICI, D. C. BILES AND A. LEBEDINSKY, *An application of time scales to economics*, Math. Comput. Modelling, **43**, 7-8 (2006), 718–726.
- [3] Z. BARTOSIEWICZ AND D. F. M. TORRES, *Noether's theorem on time scales*, J. Math. Anal. Appl., **342**, 2 (2008), 1220–1226.
- [4] M. BOHNER, *Calculus of variations on time scales*, Dynam. Systems Appl., **13**, 3-4 (2004), 339–349.
- [5] M. BOHNER AND T. MATTHEWS, *Ostrowski inequalities on time scales*, JIPAM. J. Inequal. Pure Appl. Math., **9**, 1 (2008), Article 6, 8 pp.
- [6] M. BOHNER AND A. PETERSON, *Dynamic equations on time scales*, Birkhäuser Boston, Boston, MA, 2001.
- [7] M. BOHNER AND A. PETERSON, *Advances in dynamic equations on time scales*, Birkhäuser Boston, Boston, MA, 2003.
- [8] W.-S. CHEUNG, *Integral inequalities and applications to the calculus of variations*, Int. J. Appl. Math., **9**, 1 (2002), 85–108.
- [9] O. DUNKEL, *Integral Inequalities With Applications to the Calculus of Variations*, Amer. Math. Monthly, **31**, 7 (1924), 326–337.
- [10] R. A. C. FERREIRA, M. R. SIDI AMMI AND D. F. M. TORRES, *Diamond-alpha integral inequalities on time scales*, Int. J. Math. Stat., **5**, A09 (2009), 52–59.
- [11] R. A. C. FERREIRA AND D. F. M. TORRES, *Remarks on the calculus of variations on time scales*, Int. J. Ecol. Econ. Stat., **9**, F07 (2007), 65–73.
- [12] R. A. C. FERREIRA AND D. F. M. TORRES, *Higher-order calculus of variations on time scales*, in *Mathematical Control Theory and Finance*, Springer, 2008, 149–159.
- [13] R. A. C. FERREIRA AND D. F. M. TORRES, *Generalizations of Gronwall-Bihari inequalities on time scales*, J. Difference Equ. Appl., **15**, 6 (2009), 529–539.
- [14] R. A. C. FERREIRA AND D. F. M. TORRES, *Isoperimetric problems of the calculus of variations on time scales*, Contemporary Mathematics (2010), in press.
- [15] G. H. HARDY, J. E. LITTLEWOOD, *Some integral inequalities connected with the calculus of variations*, Q. J. Math., Oxf. Ser., **3** (1932), 241–252.
- [16] G. H. HARDY, J. E. LITTLEWOOD AND G. PÓLYA, *Inequalities*, 2nd ed., Cambridge University Press, 1952.
- [17] S. HILGER, *Analysis on measure chains—a unified approach to continuous and discrete calculus*, Results Math., **18**, 1-2 (1990), 18–56.
- [18] S. HILGER, *Differential and difference calculus—unified!*, Nonlinear Anal., **30**, 5 (1997), 2683–2694.

- [19] R. HILSCHER AND V. ZEIDAN, *Calculus of variations on time scales: weak local piecewise C_{rd}^1 solutions with variable endpoints*, J. Math. Anal. Appl., **289**, 1 (2004), 143–166.
- [20] A. B. MALINOWSKA AND D. F. M. TORRES, *Necessary and sufficient conditions for local Pareto optimality on time scales*, J. Math. Sci. (N. Y.), **161**, 6 (2009), 803–810.
- [21] C. SBORDONE, *On some integral inequalities and their applications to the calculus of variations*, Boll. Un. Mat. Ital. C (6), **5**, 1 (1986), 73–94.
- [22] M. R. SIDI AMMI, R. A. C. FERREIRA AND D. F. M. TORRES, *Diamond- α Jensen's inequality on time scales*, J. Inequal. Appl., **2008**, Art. ID 576876, 13 pp.
- [23] M. R. SIDI AMMI AND D. F. M. TORRES, *Combined dynamic Grüss inequalities on time scales*, J. Math. Sci. (N. Y.), **161**, 6 (2009), 792–802.
- [24] F.-H. WONG, C.-C. YEH AND W.-C. LIAN, *An extension of Jensen's inequality on time scales*, Adv. Dyn. Syst. Appl., **1**, 1 (2006), 113–120.