

NEW QUANTUM INTEGRAL INEQUALITIES VIA m -CONVEX FUNCTIONS OVER FINITE INTERVAL

MIGUEL VIVAS-CORTEZ*, ARTION KASHURI,
MUHAMMAD RAEES AND MATLOOB ANWAR

Abstract. First we consider a new trapezium identity for twice differentiable functions in quantum integrals. This identity investigates our main results that consist some integral inequalities of trapezium type using the newly introduced q -derivatives for the m -convex functions over finite intervals of real numbers. Some special cases are discussed in details to support our theoretical results.

Mathematics subject classification (2020): Primary 26A51; Secondary 26A33, 26D07, 26D10, 26D15.

Keywords and phrases: Hermite–Hadamard inequality, Hölder’s inequality, power mean inequality, m -convex functions, q -derivatives, q -integrals.

REFERENCES

- [1] N. ALP, M. Z. SARIKAYA, *Quantum Hermite–Hadamard’s type inequalities for co-ordinated convex functions*, Appl. Math. E-Notes., **20** (2020), 341–356.
- [2] S. BERMUDO, P. KÓRUS, J. E. NÁPOLES VALDÉS, *On q -Hermite–Hadamard inequalities for general convex functions*, Acta Math. Hungar., **162** (1) (2020), 364–374.
- [3] V. KAC, P. CHEUNG, *Quantum calculus*, Springer, Berlin, New York (2001).
- [4] P. K. LAM, *Special Relativity at the Quantum scale*, PloS ONE., **9** (2014).
- [5] W. LIU, W. WEN, J. PARK, *Hermite–Hadamard type inequalities for MT -convex functions via classical integrals and fractional integrals*, J. Nonlinear Sci. Appl., **9** (2016), 766–777.
- [6] W. LIU, H. ZHUANG, *Some quantum estimates of Hermite–Hadamard inequalities for convex functions*, J. Appl. Anal. Comput., **7** (2) (2017), 501–522.
- [7] M. A. NOOR, K. I. NOOR, M. U. AWAN, *Some quantum estimates for Hermite–Hadamard inequalities*, Appl. Math. Comput., **251** (2015), 675–679.
- [8] S. RAFEEQ, K. KALSOOM, S. HUSSAIN, S. RASHID, Y. M. CHU, *Delay dynamic double integral inequalities on time scale with applications*, Adv. Differ. Equ., **1** (2020), 1–32.
- [9] W. SUDSUTAD, S. K. NTOUYAS, J. TARIBOON, *Quantum integral inequalities for convex functions*, J. Math. Inequal., **9** (3) (2015), 781–793.
- [10] J. TARIBOON, S. K. NTOUYAS, *Quantum calculus on finite intervals and applications to impulsive difference equations*, Adv. Diff. Equ., **282** (2013), 1–19.
- [11] J. TARIBOON, S. K. NTOUYAS, *Quantum integral inequalities on finite intervals*, J. Inequal. Appl., **2014** (121) (2014).
- [12] G. TOADER, *Some generalizations of the convexity*, In: Proc. Colloq. Approx. Optim. Cluj-Napoca, Romania, Univ. Cluj-Napoca, (1985), 329–338.
- [13] M. TUNÇ, E. GÖV, *(p, q) -integral inequalities*, RGMIA Res. Rep. Coll., **19** (2016), 1–13.
- [14] M. TUNÇ, E. GÖV, *Some integral inequalities via (p, q) -calculus on finite intervals*, RGMIA Res. Rep. Coll., **19** (2018), 649–664.
- [15] M. TUNC, E. GOV, U. ŞANAL, *On tgs-convex functions and their inequalities*, Facta. Un.v., Ser. Math. Inform., **30** (2015), 670–691.
- [16] S. VAROŠANEC, *On h -convexity*, J. Math. Anal. Appl., **326** (1) (2007), 303–311.
- [17] M. VIVAS-CORTEZ, A. KASHURI, J. E. H. HERNÁNDEZ, *Trapezium-type inequalities for Raina’s fractional integrals operator using generalized convex functions*, Symmetry, **12** (6) (2020), pp. 17.

- [18] M. VIVAS-CORTEZ, M. A. ALI, A. KASHURI, I. B. SIAL, Z. ZHANG, *Some new Newton's type integral inequalities for co-ordinated convex functions in Quantum Calculus*, *Symmetry*, **12** (9) (2020), pp. 28.
- [19] M. VIVAS-CORTEZ, A. KASHURI, R. LIKO, J. E. HERNÁNDEZ HERNÁNDEZ, *Some new q -integral inequalities using generalized Quantum Montgomery identity via preinvex functions*, *Symmetry*, **12** (4) (2020), pp. 15.
- [20] M. VIVAS-CORTEZ, A. KASHURI, R. LIKO, J. E. HERNÁNDEZ HERNÁNDEZ, *Some inequalities using generalized convex functions in Quantum Analysis*, *Symmetry*, **11** (11) (2019), pp. 14.
- [21] M. VIVAS-CORTEZ, A. KASHURI, R. LIKO, J. E. HERNÁNDEZ HERNÁNDEZ, *Quantum estimates of Ostrowski inequalities for generalized ϕ -convex functions*, *Symmetry*, **11** (12) (2019), pp. 1513.
- [22] M. VIVAS-CORTEZ, A. KASHURI AND J. E. HERNÁNDEZ HERNÁNDEZ, *On φ -Convex Stochastic Processes and Integral Inequalities Related*, *Applied Mathematics and Information Sciences*: **14** (6), (2020) Article 1.