

SOME REVERSES OF THE CAUCHY—SCHWARZ INEQUALITY FOR COMPLEX FUNCTIONS OF SELF-ADJOINT OPERATORS IN HILBERT SPACES

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Abstract. We give some ratio and difference reverses of the Cauchy–Schwarz inequality for complex functions of self-adjoint operators in Hilbert spaces, under suitable assumptions for the involved operators. Several examples for particular functions of interest are provided as well.

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REFERENCES

- [1] L. J. ARAMBASIĆ, D. BAKIĆ AND M. S. MOSLEHIAN, *A treatment of the Cauchy–Schwarz inequality in C^* -modules*, J. Math. Anal. Appl. **381** (2011), 546–556.
- [2] S. S. DRAGOMIR, *A survey on Cauchy–Bunyakovsky–Schwarz type discrete inequalities*, J. Inequal. Pure Appl. Math. **4** (2003), Article 63, 142 pp.
- [3] R. P. AGARWAL AND S. S. DRAGOMIR, *A survey of Jensen type inequalities for functions of self-adjoint operators in Hilbert spaces*, Comput. Math. Appl. **59** (2010), 3785–3812.
- [4] Y. J. CHO, S. S. DRAGOMIR, C. E. M. PEARCE AND S. S. KIM, *Cauchy–Schwarz functionals*, Bull. Austral. Math. Soc. **62**(2000), 479–491.
- [5] S. S. DRAGOMIR, *Čebyšev’s type inequalities for functions of selfadjoint operators in Hilbert spaces*, Linear Multilinear Algebra **58** (2010), 805–814.
- [6] S. S. DRAGOMIR, *Vector and operator trapezoidal type inequalities for continuous functions of self-adjoint operators in Hilbert spaces*, Electron. J. Linear Algebra **22** (2011), 161–178.
- [7] S. S. DRAGOMIR, *Ostrowskis type inequalities for continuous functions of selfadjoint operators on Hilbert spaces: a survey of recent results*, Ann. Funct. Anal. **2** (2011), 139–205.
- [8] S. S. DRAGOMIR, *Some new Grüss’ type inequalities for functions of selfadjoint operators in Hilbert spaces*, Preprint, RGMIA Res. Rep. Coll. **11** (2008), Supplement. Art. 12, [http://rgmia.org/v11\(E\).php](http://rgmia.org/v11(E).php).
- [9] S. S. DRAGOMIR, Y. J. CHO AND S. S. KIM, *Some inequalities in inner product spaces related to the generalized triangle inequality*, Appl. Math. Comput. **217** (2011), 7462–7468.
- [10] S. S. DRAGOMIR, Y. J. CHO AND J. K. KIM, *Subadditivity of some functionals associated to Jensen’s inequality with applications*, Taiwan. J. Math. **15** (2011), 1815–1828.
- [11] J. I. FUJII, *Operator-valued inner product and operator inequalities*, Banach J. Math. Anal. **2** (2008), 59–67.
- [12] J. I. FUJII, M. FUJII, M. S. MOSLEHIAN AND Y. SEO, *Cauchy–Schwarz inequality in semi-inner product C^* -modules via polar decomposition*, J. Math. Anal. Appl. **394** (2012), no. 2, 835–840.
- [13] M. FUJII, S. IZUMINO, R. NAKAMOTO AND Y. SEO, *Operator inequalities related to Cauchy–Schwarz and Hölder–McCarthy inequalities*, Nihonkai Math. J. **8** (1997), 117–122.
- [14] T. FURUTA, J. MIČIĆ HOT, J. PEČARIĆ AND Y. SEO, *Mond–Pečarić Method in Operator Inequalities*, Inequalities for Bounded Selfadjoint Operators on a Hilbert Space, Element, Zagreb, 2005.
- [15] D. ILIŠEVIĆ AND S. VAROŠANEC, *On the Cauchy–Schwarz inequality and its reverse in semi-inner product C^* -modules*, Banach J. Math. Anal. **1** (2007), 78–84.

- [16] M. S. KLAMKIN AND R. G. MCLENAGHAN, *An ellipse inequality*, Math. Mag. **50** (1977), 261–263.
- [17] C. S. LIN AND Y. J. CHO, *On Holder–McCarthy–type inequalities with power*, J. Korean Math. Soc. **39** (2002), 351–361.
- [18] C. S. LIN AND Y. J. CHO, *On norm inequalities of operators on Hilbert spaces*, **2** (2003), 165–173, Inequality Theory and Applications, edited by Y. J. Cho, J. K. Kim and S. S. Dragomir, Nova Science Publishers, Inc., New York, 2003.
- [19] C. S. LIN AND Y. J. CHO, *Characteristic property for inequalities of bounded linear operators*, **4** (2007), 85–92, Inequality Theory and Applications, edited by Y. J. Cho, J. K. Kim and S. S. Dargomir,
- [20] M. S. MOSLEHIAN AND L.-E. PERSSON, *Reverse Cauchy–Schwarz inequalities for positive C^* -valued sesquilinear forms*, Math. Inequal. Appl. **12** (2009), 701–709.
- [21] G. J. MURPHY, *C^* -algebras and Operator Theory*, Academic Press, Boston, 1990.
- [22] N. OZEKI, *On the estimation of the inequalities by the maximum, or minimum values*, J. College Arts Sci. Chiba Univ. **5** (1969), 199–203.
- [23] G. PÓLYA AND G. SZEGÖ, *Aufgaben und Lehrstze aus der Analysis. Band I: Reihen, Integralrechnung, Funktionentheorie* (in German), 4th Ed., Springer-Verlag, Berlin, 1970 (original version: Julius Springer Berlin, 1925).