

ON COMPLETE MONOTONICITY OF SOME FUNCTIONS RELATED TO MEANS

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Abstract. We show the complete monotonicity of some functions related to the Stolarsky mean which was a problem of S.-X. Chen and F. Qi (2007) [15]. In the proof, the connection between operator monotone and completely monotonic functions is used.

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REFERENCES

- [1] H. ALZER AND C. BERG, *Some classes of completely monotonic functions*, Annales Acad. Sci. Fenn. Math. **27**, 2 (2002), 445–460.
- [2] R. BHATIA, *Matrix Analysis*, Springer, New York, 1996.
- [3] R. BHATIA, H. KOSAKI, *Mean matrices and infinite divisibility*, Linear Algebra Appl. **424** (2007), 36–54.
- [4] R. P. BOAS, JR., *Signs of derivatives and analytic behavior*, Amer. Math. Monthly **78**, 10 (1971), 1085–1093.
- [5] P. S. BULLEN, *Handbook of means and their inequalities*, Mathematics and its Applications, Vol. 560, Kluwer Academic Publishers Group, Dordrecht, 2003.
- [6] T. BURIĆ, N. ELEZOVIĆ, *Some completely monotonic functions related to the psi function*, Math. Inequal. Appl. **14**, 3 (2011), 679–691.
- [7] C.-P. CHEN, *Complete monotonicity and logarithmically complete monotonicity properties for the gamma and psi functions*, J. Math. Anal. Appl. **336**, 2 (2007), 812–822.
- [8] T. FURUTA, *Concrete examples of operator monotone functions obtained by an elementary method without appealing to Löwner integral representation*, Linear Algebra Appl. **429**, 5–6 (2008), 972–980.
- [9] H. VAN HAERINGEN, *Completely monotonic and related functions*, J. Math. Anal. Appl. **204** (1996), 389–408.
- [10] F. HANSEN, *Some operator monotone functions*, Linear Algebra Appl. **430** (2009), 795–799.
- [11] E. HEINZ, *Beiträge zur Störungstheorie der Spektralzerlegung*, Math. Ann. **123** (1951), 415–438.
- [12] F. KUBO, T. ANDO, *Means of positive linear operators*, Math. Ann. **246** (1980), 205–224.
- [13] E. B. LEACH, M. C. SCHOLANDER, *Extended mean values*, Amer. Math. Monthly **85** (1978) 84–90.
- [14] K. LÖWNER, *Über monotone Matrixfunktionen*, Math Z. **38** (1934), 177–216.
- [15] F. QI, S.-X. CHEN, *Complete monotonicity of the logarithmic mean*, Math. Inequal. Appl. **10**, 4 (2007), 799–804.
- [16] F. QI, S. GUO, B.-N. GUO, *Complete monotonicity of some functions involving polygamma functions*, J. Comput. Appl. Math. **233**, 9 (2010), 2149–2160.
- [17] R. L. SCHILLING, R. SONG, Z. VONDRAČEK, *Bernstein Functions: Theory and Applications*, de Gruyter Studies in Mathematics 37, Springer, Berlin, 2010.
- [18] H. ŞEVLİ, N. BATIR, *Complete monotonicity results for some functions involving the gamma and polygamma functions*, Math. Comput. Model. **53** (2011), 1771–1775.
- [19] K. B. STOLARSKY, *Generalizations of the logarithmic mean*, Math. Mag. **48** (1975), 87–92.
- [20] D. V. WIDDER, *The Laplace Transform*, Princeton University Press, Princeton, 1946.