

INEQUALITIES INVOLVING CIRCULAR, HYPERBOLIC AND EXPONENTIAL FUNCTIONS

YOGESH J. BAGUL

Abstract. This paper is aimed at obtaining some new lower and upper bounds for the functions $\cos x$, $\sin x/x$, $x/\cosh x$, thus establishing inequalities involving circular, hyperbolic and exponential functions.

Mathematics subject classification (2010): 26D05, 26D07.

Keywords and phrases: Jordan's inequality, circular, hyperbolic, exponential, lower-upper bound.

REFERENCES

- [1] D. S. MITRINOVIC, *Analytic Inequalities*, Springer-Verlag, New York, Berlin 1970.
- [2] EDWARD NEUMAN AND JÓZSEF SÁNDOR, *Optimal Inequalities For Hyperbolic And Trigonometric Functions*, Bulletin of Mathematical Analysis and Applications, vol. 3, Issue 3(2011), pages 177–181.
- [3] FENG QI, DA-WEI NIU, AND BAI-NI GUO, *Refinements, Generalizations, and Applications of Jordan's inequality and related problems*, Journal of Inequalities and Applications, vol. 2009, Article ID 271923, 52 pages, 2009.
- [4] G. D. ANDERSON, M. K. VAMANAMURTHY, M. VUORINEN, *Conformal Invariants, Inequalities and Quasiconformal maps*, John Wiley and Sons, New York, 1997.
- [5] L. ZHU, J. SUN, *Six new Redheffer-type inequalities for circular and hyperbolic functions*, comput. Math. Appl. 56 (2) (2008), pages 522–529.
- [6] P. S. BULLEN, *A Directory of Inequalities*, Pitman Monographs and Surveys in Pure and Applied Mathematics, vol. 97, Addison Wesley Longman Limited, Longman, Harlow 1998.
- [7] R. KLÉN, M. VISURI AND M. VUORINEN, *On Jordan Type Inequalities for Hyperbolic Functions*, J. Inequal. and Appl. (2010) 14 pp. (2010) Art. ID 362548.
- [8] YUPEI LV, GENDI WANG, YUMIG CHU, *A note on Jordan type inequalities for hyperbolic functions*, Appl. Math. Lett. 25 (2012) pages 505–508.
- [9] CĂTĂLIN BARBU AND LAURIAN-IOAN PIȘCORAN, *Jordan type Inequalities using Monotony of Functions*, Journal of Mathematical Inequalities, vol. 8, no. 1 (2014), 83–89.
- [10] BHAYO, B. A. AND SÁNDOR, *On certain old and new trigonometric and hyperbolic inequalities*, J. Anal. Math(2015) 41:3.
- [11] ZHEN-HANG YANG, YU-MING CHU, *Jordan Type Inequalities for Hyperbolic Functions and Their Applications*, Journal of Function Spaces, vol. 2015, Article ID 370979, 4 pages, 2015.