CHEBYSHEV'S DIFFERENTIAL EQUATION AND ITS HYERS-ULAM STABILITY

SOON-MO JUNG AND BYUNGBAE KIM

Abstract. We solve the inhomogeneous Chebyshev's differential equation and apply this result to obtain a partial solution to the Hyers-Ulam stability problem for the Chebyshev's differential equation.

Mathematics subject classification (2000): Primary 34A05, 39B82; Secondary 26D10, 34A40. *Keywords and phrases*: Chebyshev's differential equation, Chebyshev function, Hyers-Ulam stability, approximation.

REFERENCES

- C. ALSINA AND R. GER, On some inequalities and stability results related to the exponential function, J. Inequal. Appl. 2 (1998), 373–380.
- [2] S. CZERWIK, Functional Equations and Inequalities in Several Variables, World Scientific, River Edge, NJ, 2002.
- [3] D. H. HYERS, On the stability of the linear functional equation, Proc. Nat. Acad. Sci. USA 27 (1941), 222–224.
- [4] D. H. HYERS, G. ISAC AND TH. M. RASSIAS, Stability of Functional Equations in Several Variables, Birkhäuser, Boston, 1998.
- [5] D. H. HYERS AND TH. M. RASSIAS, Approximate homomorphisms, Aequationes Math. 44 (1992), 125–153.
- [6] S.-M. JUNG, *Hyers-Ulam-Rassias Stability of Functional Equations in Mathematical Analysis*, Hadronic Press, Palm Harbor, 2001.
- [7] S.-M. JUNG, Hyers-Ulam stability of linear differential equations of first order, Appl. Math. Lett. 17 (2004), 1135–1140.
- [8] S.-M. JUNG, Hyers-Ulam stability of linear differential equations of first order, II, Appl. Math. Lett. 19 (2006), 854–858.
- [9] S.-M. JUNG, Hyers-Ulam stability of linear differential equations of first order, III, J. Math. Anal. Appl. 311 (2005), 139–146.
- [10] S.-M. JUNG, Hyers-Ulam stability of a system of first order linear differential equations with constant coefficients, J. Math. Anal. Appl. 320 (2006), 549–561.
- [11] S.-M. JUNG, Legendre's differential equation and its Hyers-Ulam stability, Abst. Appl. Anal. 2007 (2007), Article ID 56419, 14 pages, doi: 10.1155/2007/56419.
- [12] S.-M. JUNG, *Approximation of analytic functions by Airy functions*, Integral Transforms and Special Functions **19** (2008), no. 12, 885–891.
- [13] B. KIM AND S.-M. JUNG, Bessel's differential equation and its Hyers-Ulam stability, J. Inequal. Appl. 2007 (2007), Article ID 21640, 8 pages, doi: 10.1155/2007/21640.
- [14] T. MIURA, On the Hyers-Ulam stability of a differentiable map, Sci. Math. Japon. 55 (2002), 17–24.
- [15] T. MIURA, S.-M. JUNG AND S.-E. TAKAHASI, *Hyers-Ulam-Rassias stability of the Banach space valued differential equations* $y' = \lambda y$, J. Korean Math. Soc. **41** (2004), 995–1005.
- [16] T. MIURA, S. MIYAJIMA AND S.-E. TAKAHASI, Hyers-Ulam stability of linear differential operator with constant coefficients, Math. Nachrichten 258 (2003), 90–96.
- [17] T. MIURA, S. MIYAJIMA AND S.-E. TAKAHASI, A characterization of Hyers-Ulam stability of first order linear differential operators, J. Math. Anal. Appl. 286 (2003), 136–146.



- [18] TH. M. RASSIAS, On the stability of the linear mapping in Banach spaces, Proc. Amer. Math. Soc. **72** (1978), 297–300.
- [19] S.-E. TAKAHASI, T. MIURA AND S. MIYAJIMA, On the Hyers-Ulam stability of the Banach spacevalued differential equation $y' = \lambda y$, Bull. Korean Math. Soc. **39** (2002), 309–315.
- [20] S. M. ULAM, Problems in Modern Mathematics, Wiley, New York, 1964.