Journal of Mathematical Inequalities
Volume 12, Number 3 (2018), 665–675
doi:10.7153/jmi-2018-12-51

ULAM–HYERS STABILITY FOR MATRIX–VALUED FRACTIONAL DIFFERENTIAL EQUATIONS

ZHANPENG YANG, WENJUAN REN AND TIANZHOU XU

Abstract. In this paper, some Ulam-Hyers stability results for matrix-valued fractional differential equations are obtained. We also establish some sufficient conditions for the stability of matrix-valued fractional differential equations.

Mathematics subject classification (2010): 34A15, 34D20, 39B82, 47L25.
Keywords and phrases: Mittag-Leffler matrix, matrix-valued fractional differential equation, Ulam–Hyers stability.

REFERENCES

[1] A. A. KILBAS, H. M. SRIVASTAVA AND J. J. TRUJILLO, *Theory and Application of Fractional Differential Equations*, Elsevier, New York.
[2] K. B. OLDHAM AND J. SPANIER, *The Fractional Calculus*, Acadmic Press, New York.
[3] D. MATIGNON, *Stability results for fractional differential equations with applications to control processing*, Proceedings of the IMACS-SMC **2**, 1 (1996), 963–968
[4] Y. D. MA, J. G. LU AND W. D. CHEN, *Robust stability and stabilization of fractional order linear systems with positive real uncertainty*, ISA Transactions **53**, 2 (2014), 199–209.
[5] W. H. DENG, C. P. LI AND J. H. LÜ, *Stability analysis of linear fractional differential system with multiple time delays*, Nonlinear Dynamics **48**, 4 (2007), 409–416.
[6] Y. LI, Y. Q. CHEN AND I. PODLUBNY, *Mittag-Leffler stability of fractional order nonlinear dynamic systems*, Automatica **45**, 8 (2009), 1965–1969.
[7] Y. LI, Y. Q. CHEN AND I. PODLUBNY, *Stability of fractional-order nonlinear dynamic systems: Lyapunov direct method and generalized Mittag-Leffler stability*, Computers and Mathematics with Applications **59**, 5 (2010), 1810–1821.
[8] H. DELAVARI, D. BALEANU AND J. SADATI, *Stability analysis of Caputo fractional-order nonlinear systems revisited*, Nonlinear Dynamics **67**, 4 (2012), 2433–2439.
[9] S. BILAL, A. ABDULLAH AND B. ALAGOZ, *A numerical investigation for robust stability of fractional-order uncertainsystems*, ISA Transactions **53**, 2 (2014), 189–198.
[10] S. M. ULAM, *A Collection of Mathematical Problems*, Interscience Publishers, New York.
[11] D. H. HYERS, *On the stability of the linear functional equation*, Proceedings of the National Academy of Sciences of the United States of America **27**, 27 (1941), 222–224.
[12] T. AOKI, *On the stability of the linear transformation in Banach spaces*, Journal of the Mathematical Society of Japan **1950**, 2 (1950), 64–66.
[13] T. M. RASSIAS, *On the stability of the linear mapping in Banach spaces*, Proceedings of the American Mathematical Society **72**, 2 (1978), 297–300.
[14] J. M. RASSIAS, *On approximation of approximately linear mappings by linear mappings*, Journal of Functional Analysis **46**, 1 (1982), 126–130.
[15] T. Z. XU, J. M. RASSIAS AND W. X. XU, *Stability of a general mixed additive-cubic functional equation in non-Archimedean fuzzy normed spaces*, Journal of Mathematical Physics **51**, 9 (1982), 1–19.
[16] Z. P. YANG, T. Z. XU AND M. QI, *Ulam-Hyers Stability for Fractional Differential Equations in Quaternionic Analysis*, Advances in Applied Clifford Algebras **26**, 1 (2016), 1–10.

Paper JMI-12-51

[17] T. Z. XU, Z. P. YANG AND J. M. RASSIAS, *Direct and fixed point approaches to the stability of an AQ-functional equation in non-Archimedean normed spaces*, Journal of Computional Analysis and Applications **17**, 4 (2014), 697–706.
[18] S. M. JUNG AND T. M. RASSIAS, *A linear functional equation of third order associated to the Fibonacci numbers*, Abstract and Applied Analysis **2014**, 2 (2014), 1–7.
[19] S. M. JUNG, D. POPA AND T. M. RASSIAS, *On the stability of the linear functional equation in a single variable on complete metric groups*, Journal of Global Optimization **59**, 1 (2014), 165–171.
[20] S. M. JUNG, *On the Hyers-Ulam stability of the functional equations that have the quadratic property*, Journal of Mathematical Analysis and Applications **222**, 1 (1998), 126–137.
[21] J. R. WANG, L. L. LÜ AND Y. ZHOU, *New concepts and results in stability of fractional differential equations*, Communications in Nonlinear Science and Numerical Simulation **17**, 6 (2012), 2530–2538.
[22] J. R. WANG, Y. ZHOU AND M. FEC KAN, *Nonlinear impulsive problems for fractional differential equations and Ulam stability*, Computers and Mathematics with Applications **64**, 10 (2012), 3389–3405.
[23] J. R. WANG, Y. ZHOU AND M. FEC KAN, *Ulam-Hyers-Mittag-Leffler stability of fractional order delay differential equations*, Optimization **63**, 8 (2014), 1181–1190.
[24] Z. H. WANG, *Functional inequalities in matrix Banach spaces*, Journal of Mathematical Inequalities **11**, 1 (2017), 87–97.
[25] J. R. LEE, *Stability of Functional Equations in Matrix Random Normed Spaces: A Fixed Point Approach*, Results in Mathematics **66**, 1 (2014), 99–127.
[26] J. R. LEE, *Stability of functional inequalities in matrix random normed spaces*, Journal of Inequalities and Applications **2013**, 1 (2013), 1–12.
[27] M. CAPUTO, *Linear models of dissipation whose Q is almost frequency independent part II*, Geophysical Journal International **13**, 5 (2007), 529–539.
[28] Z. ODIBAT, *Analytic study on linear systems of fractional differential equations*, Computers and Mathematics with Applications **59**, 3 (2010), 1171–1183.
[29] I. A. RUS, *Picard operators and applications*, Scienticae Mathematicae Japonocae **58**, 1 (2003), 191–219.