STABILITY OF A NEW ADDITIVE FUNCTIONAL INEQUALITY IN BANACH SPACES

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Abstract. We propose and solve a new type of additive functional inequality. We also obtain the Hyers-Ulam stability of such functional inequality in a complex Banach space by using two different approaches.

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REFERENCES

- T. AOKI, On the stability of the linear transformation in Banach spaces, J. Math. Soc. Japan 2 (1950), 64–66.
- [2] M. AMYARI, C. BAAK AND M. MOSLEHIAN, Nearly ternary derivations, Taiwanese J. Math. 11 (2007), 1417–1424.
- [3] L. CĂDARIU AND V. RADU, Fixed points and the stability of Jensen's functional equation, J. Inequal. Pure Appl. Math. 4, no. 1, Art. ID 4 (2003).
- [4] L. CĂDARIU AND V. RADU, On the stability of the Cauchy functional equation: a fixed point approach, Grazer Math. Ber. 346 (2004), 43–52.
- [5] L. CĂDARIU AND V. RADU, Fixed point methods for the generalized stability of functional equations in a single variable, Fixed Point Theory Appl. 2008, Art. ID 749392 (2008).
- [6] J. DIAZ AND B. MARGOLIS, A fixed point theorem of the alternative for contractions on a generalized complete metric space, Bull. Am. Math. Soc. 74 (1968), 305–309.
- [7] I. EL-FASSI, Generalized hyperstability of a Drygas functional equation on a restricted domain using Brzdek's fixed point theorem, J. Fixed Point Theory Appl. 19 (2017), 2529–2540.
- [8] M. ESHAGHI GORDJI, A. FAZELI AND C. PARK, 3-Lie multipliers on Banach 3-Lie algebras, Int. J. Geom. Meth. Mod. Phys. 9 (2012), no. 7, Art. ID 1250052. 15 pp.
- [9] M. ESHAGHI GORDJI, M.B. GHAEMI AND B. ALIZADEH, A fixed point method for perturbation of higher ring derivations non-Archimedean Banach algebras, Int. J. Geom. Meth. Mod. Phys. 8 (2011), no. 7, 1611–1625.
- [10] P. GĂVRUTA, A generalization of the Hyers-Ulam-Rassias stability of approximately additive mappings, J. Math. Anal. Appl. 184 (1994), 431–436.
- [11] I. HWANG AND C. PARK, Ulam stability of an additive-quadratic functional equation in Banach spaces, J. Math. Inequal. 14 (2020), 421–436.
- [12] D. H. HYERS, On the stability of the linear functional equation, Proc. Nat. Acad. Sci. U.S.A. 27 (1941), 222–224.
- [13] G. ISAC AND TH. M. RASSIAS, *Stability of* ψ *-additive mappings: Applications to nonlinear analysis*, Int. J. Math. Math. Sci. **19** (1996), 219–228.
- [14] K. JUN AND Y. LEE, A generalization of the Hyers-Ulam-Rassias stability of Jensen's equation, J. Math. Anal. Appl. 238 (1) (1999), 305–315.
- [15] S. JUNG, M. TH. RASSIAS AND C. MORTICI, On a functional equation of trigonometric type, Appl. Math. Comput. 252 (2015), 294–303.



- [16] S. JUNG, D. POPA AND M. TH. RASSIAS, On the stability of the linear functional equation in a single variable on complete metric spaces, J. Global Optim. 59 (2014), 165–171.
- [17] S. JUNG, Hyers-Ulam-Rassias stability of Jensen's equation and its application, Proc. Am. Math. Soc. 126 (11) (1998), 3137–3143.
- [18] Z. KOMINEK, On a local stability of the Jensen functional equation, Demonstr. Math. 22 (2) (1989), 499–507.
- [19] Y. LEE, S. JUNG AND M. TH. RASSIAS, Uniqueness theorems on functional inequalities concerning cubic-quadratic-additive equation, J. Math. Inequal. 12 (2018), 43–61.
- [20] D. MIHEŢ AND V. RADU, On the stability of the additive Cauchy functional equation in random normed spaces, J. Math. Anal. Appl. 343 (2008), 567–572.
- [21] I. NIKOUFAR, Jordan (θ, ϕ) -derivations on Hilbert C^{*}-modules, Indag. Math. **26** (2015), 421–430.
- [22] C. PARK, Additive ρ -functional inequalities and equations, J. Math. Inequal. 9 (2015), 17–26.
- [23] C. PARK, Additive ρ-functional inequalities in non-Archimedean normed spaces, J. Math. Inequal. 9 (2015), 397–407.
- [24] C. PARK, Fixed point method for set-valued functional equations, J. Fixed Point Theory Appl. 19 (2017), 2297–2308.
- [25] C. PARK, The stability of an additive (ρ_1, ρ_2) -functional inequality in Banach spaces, J. Math. Inequal. **13** (1) (2019), 95–104.
- [26] V. RADU, The fixed point alternative and the stability of functional equations, Fixed Point Theory 4 (2003), 91–96.
- [27] TH. M. RASSIAS, On the stability of the linear mapping in Banach spaces, Proc. Am. Math. Soc. 72 (1978), 297–300.
- [28] W. SURIYACHAROEN AND W. SINTUNAVARAT, On the additive (s_1, s_2) -functional inequality and its stability in Banach spaces, Thai J. Math. **18** (3) (2020), 1375–1385.
- [29] S. M. ULAM, A Collection of the Mathematical Problems, Interscience Publ. New York, 1960.
- [30] S. YUN AND D. Y. SHIN, *Stability of an additive* (ρ_1, ρ_2) -*functional inequality in Banach spaces*, J. Korean Soc. Math. Educ. Ser. B: Pure Appl. Math. **24** (1) (2017), 21–31.
- [31] Z. WANG, Stability of two types of cubic fuzzy set-valued functional equations, Results Math. 70 (2016), 1–14.