

Graphic-like contractions

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ABSTRACT. We introduce a novel contractive condition that generalizes several known concepts like graphic contraction, almost contraction, mappings contracting perimeters and modifications. These mappings are weakly Picard operators, but independent of all mentioned classes which is substantiated with numerous examples.

REFERENCES

- [1] Altun, I.; Hancıer, H. A.; Minak, G. On a general class of weakly Picard operators. *Miskolc Math. Notes* **16**(1) (2015), 25–32.
- [2] Banach, S. Sur les opérations dans les ensembles abstraits et leur application aux équations intégrales. (French) [[On the operations in abstract sets and their application to integral equations]]. *Fund. Math.* **3** (1922), 133-181.
- [3] Berinde, V. Approximating fixed points of weak contractions using the Picard iteration. *Nonlinear Anal. Forum.* **9** (2004) no. 1, 43–53.
- [4] Berinde, V. General constructive fixed point theorems for Ćirić-type almost contractions in metric spaces. *Carpathian J. Math.* **2** (2008), no 2, 10–19.
- [5] Berinde, V. Approximating fixed points of implicit almost contractions. *Hacet. J. Math. Stat.* **41** (2012), no. 1, 93–102.
- [6] Berinde, V.; Păcurar, M. Approximating fixed points of enriched contractions in Banach spaces. *J. Fixed Point Theory Appl.* **22** (2020), no. 2, Paper No. 38, 10 pp.
- [7] Bisht, R. K.; Petrov, E. Three point analogue of Ćirić-Reich-Rus type mappings with non-unique fixed points. *J. Anal.* **32** (2024), no. 5, 2609–2627.
- [8] Chatterjea, S. K. Fixed-point theorems. *C. R. Acad. Bulgare Sci.* **25** (1972), 727–730.
- [9] Ćirić, Lj. B. On contraction type mappings. *Math. Balkanica* **1** (1971), 52–57.
- [10] Connell, E. H. Properties of fixed point spaces. *Proc. Amer. Math. Soc.* **10** (1959), no. 6, 974–979.
- [11] Cvetković, M. Another perspective on Kannan contraction. *Hacet. J. Math. Stat.* **54** (2025), no. 3, 972–983.
- [12] Filip, A-D. Metric conditions, graphic contractions and weakly Picard operators. *SStud. Univ. Babeş-Bolyai Math.* **70** (2025), no. 1, 161–174.
- [13] Kannan, R. Some remarks on fixed points *Bull. Calcutta Math. Soc.* **60** (1960), 71-76.
- [14] Karapınar, E. Edelstein type fixed point theorems. *Fixed Point Theory Appl.* **2012**, 2012:107, 12 pp.
- [15] Karapınar, E.; Fulga, A.; Petruşel, A. On Istrăţescu type contractions in b-metric spaces. *Mathematics* **8** (2020), no. 3, 388.
- [16] Hardy, G. E.; Rogers, T. D. A generalization of a fixed point theorem of Reich. *Canad. Math. Bull.* **16** (1973), 201–206.
- [17] Hieu, D.T.; Hung, B.T. Some fixed point theorems for weakly Picard operators in complete metric spaces and applications, *Commun. Korean Math. Soc.* (37) (2022), no. 1, 75–89.
- [18] Meyers, P. R. A converse to Banach’s contraction theorem. *J. Res. Nat. Bur. Standards Sect. B* **71B** (1967), 73–76.
- [19] Olaru, I. M. A study of a nonlinear integral equation via weakly Picard operators. *Fixed Point Theory* **16** (2015), no. 1, 163–173.
- [20] Păcurar, C. M.; Popescu, O. Fixed point theorem for generalized Chatterjea type mappings. *Acta Math. Hungar.* **173** (2024), no. 2, 500–509.
- [21] Petrov, E., Fixed point theorem for mappings contracting perimeters of triangles. *J. Fixed Point Theory Appl.* **25** (2023), no. 3, Paper No. 74, 11 pp.

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- [22] Petrov, E.; Bisht, R. K. Fixed point theorem for generalized Kannan type mappings. *Rend. Circ. Mat. Palermo II. Ser.* **73** (2024), no. 8, 2895–2912
- [23] Petrov, E.; Salimov R. Fixed point theorem for mappings contracting perimeters of triangles and its generalizations. *Algebraic and Geometric Methods of Analysis* **25** (2023), no. 84.
- [24] Petruşel, A. Multivalued weakly Picard operators and applications. *Sci. Math. Jpn.* **59** (2004), no. 1, 169–202.
- [25] Petruşel, A.; Rus, I.A. Graphic contraction principle and applications. *Mathematical analysis and applications*, 411–432, Springer Optim. Appl., 154, Springer, Cham, 2019.
- [26] Petruşel, A.; Rus, I. A.; Şerban, M.-A. Nonexpansive operators as graphic contractions, *J. Nonlinear Convex Anal.* **17** (2016), no. 7, 1409–1415.
- [27] Petruşel, A.; Petruşel, G. Graphical contractions and common fixed points in b-metric spaces. *Arab. J. Math.* **12** (2023), no. 2, 423–430.
- [28] Petruşel, A.; Petruşel, G.; Yao, J.-C. Fixed points and coupled fixed points for graphic contractions in complete b-metric spaces. *J. Nonlinear Convex Anal.* **19** (2018), no. 11, 1869–1882.
- [29] Rheinboldt, W.C. A unified convergence theory for a class of iterative processes. *SIAM J. Numer. Anal.* **5** (1968), 42–63.
- [30] Rhoades, B.E. A comparison of various definitions of contractive mappings. *Trans. Am. Math. Soc.* **226** (1977), 257–290.
- [31] Rhoades, B.E. A collection of contractive definitions. *Math. Sem. Notes Kobe Univ.* **6** (1978), no. 2, 229–235.
- [32] Rhoades, B.E. Contractive definitions revisited. *Topological methods in nonlinear analysis (Toronto, Ont., 1982)*, 189–205, Contemp. Math. 21, Amer. Math. Soc., Providence, RI, 1983.
- [33] Roy, K. Mappings contracting axes of ellipse. *J. Anal.* **32** (2024), no. 6, 3557—3563.
- [34] Rus, I.A. Weakly Picard mappings. *Comment. Math. Univ. Caroline* **34** (1993), no. 4, 769–773.
- [35] Rus, I.A. Weakly Picard operators and applications. *Semin. Fixed Point Theory Cluj-Napoca* **2** (2001), 41–57.
- [36] Rus, I.A. Picard operators and applications. *Sci. Math. Japan* **58** (2003), no. 1, 191–219.
- [37] Rus, I. A.; Mureşan, A. S.; Mureşan, V. Weakly Picard operators on a set with two metrics. *Fixed Point Theory* **6** (2005), no. 2, 323—331.
- [38] Rus, I.A. Remarks on Ulam stability of the operatorial equations. *Fixed Point Theory* **10** (2009), no. 2, 305—320.
- [39] Rus, I.A. Relevant classes of weakly Picard operators. *An. Univ. Vest Timiş. Ser. Mat.-Inform.* **54** (2016), no. 2, 131–147.
- [40] Sintunavarat, W.; Pitea, A. On a new iteration scheme for numerical reckoning fixed points of Berinde mappings with convergence analysis. *J. Nonlinear Sci. Appl.* **9** (2016), no. 6, 2553–2562.
- [41] Subrahmanyam, P. V. Completeness and fixed-points. *Monatsh. Math.* **80** (1975), no. 4, 325–330.

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