

FIXED POINT THEOREMS FOR MULTIVALUED NONSELF KANNAN-BERINDE CONTRACTION MAPPINGS IN COMPLETE METRIC SPACES

JENWIT PUANGPEE* AND SUTHEP SUANTAI**

*Department of Mathematics, Faculty of Science
Chiang Mai University, Chiang Mai 50200, Thailand
E-mail: jenwit.pp@hotmail.com

**Data Science Research Center
Department of Mathematics, Faculty of Science
Chiang Mai University, Chiang Mai 50200, Thailand
E-mail: suthep.s@cmu.ac.th

Abstract. In this paper, a new type of multivalued nonself Kannan-Berinde contraction mappings in metric spaces is introduced and studied. We establish the existence of fixed points of this type of mappings on a complete convex metric space. Our main results extend and generalize many well-known fixed point theorems of many other authors in the literature. We also give an example to illustrate our main results.

Key Words and Phrases: Fixed point, nonself multivalued mappings, Kannan-Berinde contraction, Rothe's boundary condition.

2010 Mathematics Subject Classification: 47H10, 54H25, 47H09.

Acknowledgment. The authors would like to thank Chiang Mai University, Chiang Mai, Thailand for the financial support.

REFERENCES

- [1] M.R. Alfuraidan, *Fixed points of multivalued mappings in modular function spaces with a graph*, Fixed Point Theory Appl., **2015**(2015), no. 2015:42.
- [2] M.R. Alfuraidan, *Remarks on monotone multivalued mappings on a metric space with a graph*, J. Inequal. Appl., **2015**(2015), no. 7.
- [3] M.A. Alghamdi, V. Berinde, N. Shahzad, *Fixed points of multivalued nonself almost contractions*, J. Appl. Math., **2013**(2013).
- [4] N.A. Assad, *On some nonself nonlinear contractions*, Math. Japon., **33**(1988), no. 1, 17-26.
- [5] N.A. Assad, *On some nonself mappings in Banach spaces*, Math. Japon., **33**(1988), no. 4, 501-515.
- [6] N.A. Assad, *A fixed point theorem in Banach space*, Publ. Inst. Math. (Beograd) (N.S.), **47**(1990), no. 61, 137-140.
- [7] N.A. Assad, *A fixed point theorem for some non-self-mappings*, Tamkang J. Math., **21**(1990), no. 4, 387-393.
- [8] N.A. Assad, W.A. Krik, *Fixed point theorems for set-valued mappings of contractive type*, Pacific J. Math., **43**(1972), no. 3, 553-562.

- [9] L. Balog, V. Berinde, *Fixed point theorems for nonself Kannan type contractions in Banach spaces endowed with a graph*, Carpathian J. Math., **32**(2016), no. 3, 293-302.
- [10] S. Banach, *Sur les operations dans les ensembles abstraits et leur application aux équations intégrales*, Fundam. Math., **3**(1922), 133-181.
- [11] V. Berinde, *Approximating fixed points of weak contractions using the Picard iteration*, Nonlinear Analysis Forum, **9**(2004), no. 1, 43-53.
- [12] M. Berinde, V. Berinde, *On a general class multi-valued weakly Picard mappings*, J. Math. Anal. Appl., **326**(2007), 772-782.
- [13] V. Berinde, M. Pacurar, *Fixed point theorems for nonself single-valued almost contractions*, Fixed Point Theory, **14**(2013), no. 2, 301-312.
- [14] V. Berinde, M.A. Petric, *Fixed point theorems for cyclic non-self singlevalued almost contractions*, Carpathian J. Math., **31**(2015), no. 3, 289-296.
- [15] F. Bojor, *Fixed point theorems for Reich type contraction on metric spaces with a graph*, Nonlinear Anal., **75**(2012), 3895-3901.
- [16] A. Branciari, *A fixed point theorem for mappings satisfying a general contractive condition of integral type*, Int. J. Math. Math. Sci., **29**(2002), no. 9, 531-536.
- [17] S.K. Chatterjea, *Fixed point theorems*, C.R. Acad. Bulgare Sci., **25**(1972), 727-730.
- [18] L.B. Čirić, *A remark on Rhoades' fixed point theorem for non-self mappings*, Internat. J. Math. Math. Sci., **16**(1993), 397-400.
- [19] L.B. Čirić, J.S. Ume, M.S. Khan, H.K. Pathak, *On some nonself mappings*, Math. Nachr., **251**(2003), 28-33.
- [20] A. Hanjing, S. Suantai, *Coincidence point and fixed point theorems for a new type of G-contraction multivalued mappings on a metric space endowed with a graph*, Fixed Point Theory Appl., **2015**(2015), no. 2015:171.
- [21] S. Itoh, *Multivalued generalized contractions and fixed point theorems*, Comment. Math. Univ. Carolinae, **18**(1977), 247-258.
- [22] R. Kannan, *Some results on fixed points*, Bull. Calcutta Math. Soc., **10**(1968), 71-76.
- [23] W.A. Kirk, P.S. Srinivasan, P. Veeramani, *Fixed points for mappings satisfying cyclical contractive conditions*, Fixed Point Theory, **4**(2003), no. 1, 79-89.
- [24] C. Klanarong, S. Suantai, *Coincidence point theorems for some multi-valued mappings in complete metric spaces endowed with a graph*, Fixed Point Theory Appl., **2015**(2015), no. 2015:129.
- [25] S.B. Nadler, *Multi-valued contraction mappings*, Pac. J. Math., **30**(1969), no. 2, 475-488.
- [26] J.J. Nieto, R. Rodriguez-Lopez, *Contractive mapping theorems in partially ordered sets and applications to ordinary differential equation*, **22**(2005), 223-239.
- [27] J.J. Nieto, R. Rodriguez-Lopez, *Existence and uniqueness of fixed point in partially ordered sets and applications to ordinary differential equation*, Acta Math. Sin. (Engl. Ser.), **23**(2007), no. 12, 2205-2212.
- [28] A.C.M. Ran, M.C.B. Reurings, *A fixed point theorem in partially ordered sets and some applications to matrix equations*, Proc. Amer. Math. Soc., **132**(2004), no. 5, 1435-1443.
- [29] A. Roldán, J. Martínez-Moreno, C. Roldán, E. Karapinar, *Some remarks on multidimensional fixed point theorems*, Fixed Point Theory, **15**(2014), no. 2, 545-558.
- [30] P. Sridarat, S. Suantai, *Caristi fixed point theorems in metric spaces with a graph and its applications*, J. Nonlinear Convex Anal., **17**(2016), no. 7, 1417-1428.
- [31] W. Takanishi, *Nonlinear Functional Analysis*, Yokohama Publishers, Yokohama, 2000.
- [32] J. Tiammee, S. Suantai, *Coincidence point theorems for graph-preserving multi-valued mappings*, Fixed Point Theory Appl., **2014**(2014), no. 2014:70.
- [33] K. Yanagi, *A common fixed point theorem for a sequence of multivalued mappings*, Publ. Z. Res. Inst. Math. Sci., **15**(1979), 47-52.
- [34] T. Zamfirescu, *Fixed point theorems in metric spaces*, Arch. Math. (Basel), **23**(1972), 292-298.

Received: March 20, 2017; Accepted: July 15, 2017.