

## CARISTI'S AND DOWNING-KIRK'S FIXED POINT THEOREMS ON BIPOLAR METRIC SPACES

KÜBRA ÖZKAN\*, UTKU GÜRDAL\*\* AND ALİ MUTLU\*\*\*

\*Manisa Celâl Bayar University, Department of Mathematics, 45140, Manisa, Turkey  
E-mail: kubra.ozkan@hotmail.com

\*\*Burdur Mehmet Âkif Ersoy University, Department of Mathematics, 15030, Burdur, Turkey  
E-mail: utkugurdal@gmail.com  
(Corresponding author)

\*\*\*Manisa Celâl Bayar University, Department of Mathematics, 45140, Manisa, Turkey  
E-mail: abgamutlu@gmail.com

**Abstract.** In this paper, we give some new fixed point results over bipolar metric spaces, that extend Caristi's and Downing-Kirk's fixed point theorems.

**Key Words and Phrases:** Bipolar metric space, fixed point, Caristi map, completeness.

**2020 Mathematics Subject Classification:** 54E50, 47H10, 54H25.

**Acknowledgment.** The authors would like to thank the referees for their careful review and insightful comments in relation to this work.

### REFERENCES

- [1] T. Abdeljawad, E. Karapınar, *Quasicone metric spaces and generalizations of Caristi Kirk's theorem*, Fixed Point Theory and Applications, (2009), doi:10.1155/2009/574387.
- [2] Ö. Acar, İ Altun, S. Romaguera, *Caristi's type mappings on complete partial metric spaces*, Fixed Point Theory, **14**(2013), no. 1, 3-10.
- [3] A. Aghajani, R. Allahyari, *Fixed-point theorems for multivalued generalized nonlinear contractive maps in partial metric spaces*, Ukrainian Mathematical Journal, **66**(2014), no. 1, 1-15.
- [4] C. Alaca, M.E. Ege, C. Park, *Fixed point results for modular ultrametric spaces*, Journal of Computational Analysis and Applications, **20**(7)(2016), 1259-1267.
- [5] M.R. Alfuraidan, M.A. Khamisi, *Caristi fixed point theorem in metric spaces with a graph*, Abstract and Applied Analysis, (2014), Article ID: 303484.
- [6] İ Altun, G. Minak, *An extension of Assad-Kirk's fixed point theorem for multivalued nonself mappings*, Carpathian Journal of Mathematics, **32**(2016), no. 2, 147-155.
- [7] B.C. Ampadu, *Some fixed point theory results for convex Reich contraction mapping of order 2*, Journal of Fixed Point Theory and Applications, **13**(2018), 1-42.
- [8] A. Arunchai, S. Plubtieng, *Caristi's random fixed point theorem for generalized distance on Polish spaces*, Carpathian Journal of Mathematics, **32**(2016), no. 3, 285-292.
- [9] V. Berinde, I.A. Rus, *Caristi-Browder operator theory in distance spaces*, In: Alfuraidan M.R., Ansari Q.H. (eds), Fixed Point Theory and Graph Theory, Elsevier, 2016, 1-28.

- [10] J. Caristi, *Fixed point theorems for mappings satisfying inwardness conditions*, Transactions of the American Mathematical Society, **215**(1976), 241-251.
- [11] M.M. Choban, *Fixed points for mappings defined on pseudometric spaces*, Creative Mathematics and Informatics, **22**(2013), no. 2, 173-184.
- [12] L. Ćirić, *Fixed point theorems for multi-valued contractions in complete metric spaces*, Journal of Mathematical Analysis and Applications, **348**(2008), no. 1, 499-507.
- [13] M.O. Diallo, M. Oudadess, *Extensions of Caristi-Kirk's Theorem*, Turk. J. Math., **20**(1996), no. 2, 153-158.
- [14] D. Downing, W.A. Kirk, *A generalization of Caristi's theorem with applications to nonlinear mapping theory*, Pacific Journal of Mathematics, **69**(1977), no. 2, 339-346.
- [15] A.D. Filip, A. Petruşel, *Fixed point theorems for operators in generalized Kasahara spaces*, Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales, Serie A, Matemáticas, **109**(2015), no. 1, 15-26.
- [16] A. Gupta, G.K. Soni, *Generalized coupled fixed point theorems on bipolar metric spaces*, International Journal of Mathematical Archive, **10**(4)(2019), 1-8.
- [17] E. Karapınar, *Generalizations of Caristi Kirk's theorem on partial metric spaces*, Fixed Point Theory and Applications, (2011), doi:10.1186/1687-1812-2011-4.
- [18] W.A. Kirk, *Caristi's fixed point theorem and metric convexity*, Colloquium Mathematicum, **36**(1976), no. 1, 81-86.
- [19] G.N.V. Kishore, R.P. Agarwal, B.S. Rao, R.S. Rao, *Caristi type cyclic contraction and common fixed point theorems in bipolar metric spaces with applications*, Fixed Point Theory and Applications, **21**(2018), no. 1, 1-13.
- [20] G.N.V. Kishore, K.P.R. Rao, A. Sombabu, R.V.N.S. Rao, *Related results to hybrid pair of mappings and applications in bipolar metric spaces*, Journal of Mathematics, (2019), doi:10.1155/2019/8485412.
- [21] T.A. Lazăr, A. Petruşel, N. Shahzad, *Fixed points for non-self operators and domain invariance theorems*, Nonlinear Analysis: Theory, Methods & Applications, **70**(2009), no. 1, 117-125.
- [22] A. Mutlu, U. Gürdal, *Bipolar metric spaces and some fixed point theorems*, The Journal of Nonlinear Science and Applications, **9**(2016), 5362-5373.
- [23] A. Mutlu, K. Özkan, U. Gürdal, *Coupled fixed point theorems on bipolar metric spaces*, European Journal of Pure and Applied Mathematics, **10**(4)(2017), 655-667.
- [24] A. Mutlu, K. Özkan, U. Gürdal, *Fixed point theorems for multivalued mappings on bipolar metric spaces*, Fixed Point Theory (in press).
- [25] K. Özkan, U. Gürdal, A. Mutlu, *A generalization of Amini-Harandi's fixed point theorem with an application to nonlinear mapping theory*, Fixed Point Theory (in press).
- [26] A. Petruşel, G. Petruşel, *Selection theorems for multivalued generalized contractions*, Mathematica Moravica, **9**(2005), 43-52.
- [27] B.S. Rao, G.N.V. Kishore, D. Rampasad, *Some tripled fixed point theorems in bipolar metric spaces*, International Journal of Management, Technology and Engineering, **9**(2019), no. 1, 715-727.
- [28] S. Romaguera, *A Kirk type characterization of completeness for partial metric spaces*, Fixed Point Theory and Applications, (2009), doi:10.1155/2010/493298.
- [29] N. Shioji, T. Suzuki, W. Takahashi, *Contractive mappings, Kannan mappings and metric completeness*, Proceedings of the American Mathematical Society, **126**(1998), no. 1, 3117-3124.

*Received: March 14, 2019; Accepted: August 28, 2019.*

