

## A KRASNOSELSKII-MANN TYPE ITERATION FOR NONEXPANSIVE MAPPINGS IN HADAMARD SPACES

ALI MOSLEMIPOUR AND MEHDI ROOHI

ABSTRACT. In this paper, a new type of Krasnoselskii-Mann iteration algorithm for finding a zero of nonexpansive mappings in Hadamard spaces is introduced and its convergence analysis is considered. Two examples in  $\mathbb{R}$ -tree space  $\frac{\mathbb{N} \times [0, 1]}{\sim}$  and 2-dimensional Euclidean space  $\mathbb{R}^2$  with their numerical results are given.

### REFERENCES

- [1] B. Ahmadi Kakavandi: *Weak topologies in complete CAT(0) metric spaces*, Proc. Amer. Math. Soc., **141**(2013), 1029-1039.
- [2] B. Ahmadi Kakavandi and M. Amini: *Duality and subdifferential for convex functions on complete CAT(0) metric spaces*, Nonlinear Anal., **73**(2010), 3450-3455.
- [3] M. Bačák: *Convex Analysis and Optimization in Hadamard Spaces*, Walter de Gruyter, Berlin, 2014.
- [4] I.D. Berg and I.G. Nikolaev: *Quasilinearization and curvature of Aleksanderov spaces*, Geom. Dedicata, **133**(2008), 195-218.
- [5] M. Bridson and A. Haefliger: *Metric Spaces of Nonpositive Curvature*, Grundlehren Math. Wiss., Springer, 1999.
- [6] S. Dhompongsa, A. Kaewkhao and B. Panyanak: *On Kirk's strong convergence theorem for multivalued nonexpansive mapping on CAT(0) spaces*, Nonlinear Anal., **75**(2012), 459-468.
- [7] S. Dhompongsa, W.A. Kirk and B. Sims: *Fixed points of uniformly Lipschitzian mappings*, Nonlinear Anal., **65**(2006), 762-772.
- [8] S. Dhompongsa and B. Panyanak: *On  $\Delta$ -convergence theorems in CAT(0) spaces*, Comput. Math. Appl., **56**(2008), 2572-2579.
- [9] R. Espinola and A. Fernández-León: *CAT( $k$ )-spaces, weak convergence and fixed points*, J. Math. Anal. Appl., **353**(2009), 410-427.
- [10] C. Kanzow and Y. Shehu: *Generalized Krasnoselskii-Mann-type iterations for nonexpansive mappings in Hilbert spaces*, Comput. Optim. Appl., **67**(2017), 595-620.
- [11] W.A. Kirk and B. Panyanak: *A concept of convergence in geodesic spaces*, Nonlinear Anal., **68**(2008), 3689-3696.
- [12] M.A. Krasnoselskii: *Two remarks on the method of successive approximations*, Uspekhi Mat. Nauk, **10**(1955), 123-127.
- [13] T.C. Lim: *Remarks on some fixed point theorems*, Proc. Amer. Math. Soc., **60**(1976), 179-182.
- [14] W.R. Mann: *Mean value methods in iteration*, Proc. Amer. Math. Soc., **4**(1953), 506-510.
- [15] B.T. Polyak: *Introduction to Optimization*, Optimization Software Inc., New York, 1987.
- [16] S. Reich: *Weak convergence theorems for nonexpansive mappings in Banach spaces*, J. Math. Anal. Appl., **67**(1979), 274-276.

---

Received: April 28, 2020. Revised: August 03, 2020.

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

Key words and phrases: Krasnoselskii-Mann type iteration, nonexpansive mapping, Hadamard spaces,  $\Delta$ -convergence,  $\mathbb{R}$ -tree space.

- [17] H.F. Senter and W.G. Dotson: *Approximating fixed points of nonexpansive mappings*, Proc. Amer. Math. Soc., **44**(1974), 375-380.

*Department of Mathematics*  
*Aliabad Katoul Branch*  
*Islamic Azad University*  
*Aliabad Katoul, Iran*  
*E-mail address: ali.moslemipour@gmail.com*

*Golestan University*  
*Faculty of Basic Sciences*  
*Department of Mathematics*  
*Gorgan, Golestan, Iran*  
*E-mail address: m.roohi@gu.ac.ir*