

Dedicated to Prof. Billy E. Rhoades on the occasion of his 90th anniversary

Attractive points of monotone further generalized hybrid mappings

MUJAHID ABBAS^{1,2}, HIRA IQBAL³ and SAFEER HUSSAIN KHAN⁴

ABSTRACT.

The aim of this paper is to introduce monotone further generalized mappings in a Hilbert space with partial order and study the existence and approximation results leading to attractive points for such mappings. Moreover, a numerical example is given to support our results and comparative study of the iterative processes has been done along with general discussion.

Acknowledgements. The authors are grateful to the referees for their valuable comments and suggestions which helped us in improving the presentation of the paper. The authors are also thankful to Prof. Vasile Berinde for his editorial efforts to make the timely review process possible.

REFERENCES

- [1] Baillon, J. B., *Un theoreme de type ergodique pour les contractions nonlineaires dans un espaces de Hilbert*, C. R. Acad. Sci. Paris, Ser. A-B, **280** (1975), 1511–1541
- [2] Cuntavepanit, A. and Phuengrattana, W., *Iterative approximation of attractive points of further generalized hybrid mappings in Hadamard spaces*, Fixed Point Theory Appl., **2019** (2019), 3
- [3] Kaewkhao, W. I. A. and Kunwai, K., *Attractive points and convergence theorems for normally generalized hybrid mappings in CAT(0) spaces*, Fixed Point Theory Appl., **2015** 2015:96, 14 pp.
- [4] Kanzow, C. and Shehu, Y., *Generalized Krasnoselskii-Mann-type iterations for nonexpansive mappings in Hilbert spaces*, Comput. Optim. Appl., **67** (2017), No. 3, 595–620
- [5] Khan, S. H., *A Picard-Mann hybrid iterative process*, Fixed Point Theory Appl., **2013** (2013), 69
- [6] Khan, S. H., *Iterative approximation of common attractive points of further generalized hybrid mappings*, Fixed Point Theory Appl., **2018** (2018), 8
- [7] Krasnoselskii, M. A., *Two remarks on the method of successive approximations*, Uspekhi Mat. Nauk, **10** (1955), 123–127
- [8] Maingé, P. E., *Strong convergence of projected subgradient methods for nonsmooth and nonstrictly convex minimization*, Set-Valued Anal., **16** (2008), 899–912
- [9] Mann, W. R., *Mean value methods in iteration*, Bull. Am. Math. Soc., **4** (1953), 506–510
- [10] Ran, A. C. M. and Reurings, M. C. B., *A fixed point theorem in partially ordered sets and some applications to matrix equations*, Proc. Am. Math. Soc., **132** (2004), 1435–1443
- [11] Rhoades, B. E., *Comments on two fixed point iteration methods*, J. Math. Anal. Appl., **56** (1976), No. 3, 741–750
- [12] Rhoades, B. E., *Convergence of an Ishikawa-type iteration scheme for a generalized contraction*, J. Math. Anal. Appl., **185** (1994), No. 2, 350–355
- [13] Takahashi, W. and Takeuchi, Y., *Nonlinear ergodic theorem without convexity for generalized hybrid mappings in a Hilbert space*, J. Nonlinear Convex Anal., **12** (2011), 399–406
- [14] Takahashi, N. C. W. W. and Yao, J. C., *Attractive point and weak convergence theorems for new generalized hybrid mappings in Hilbert spaces*, J. Nonlinear Convex Anal., **13** (2012), 745–757

Received: 31.01.2020; In revised form: 12.06.2020; Accepted: 12.06.2020

2010 Mathematics Subject Classification. 47H10, 47H09.

Key words and phrases. Attractive points, monotone mappings, iteration.

Corresponding author: Hira Iqbal; hira.iqbal@nu.edu.pk

- [15] Takahashi, W., *Nonlinear Functional Analysis-Fixed Point Theory and Its Applications*, Yokohama Publishers, Yokohama (2000)
- [16] Takahashi, W. and Toyoda, M., *Weak convergence theorems for nonexpansive mappings and monotone mappings*, *J. Optim. Theory Appl.*, **118** (2003), 417–428
- [17] Thakur, B. S., Thakur, D. and Postolache, M., *A new iterative scheme for numerical reckoning fixed points of Suzuki's generalized nonexpansive mappings*, *Appl. Math. Comput.*, **275** (2016), 147–155
- [18] Zheng, Y., *Attractive points and convergence theorems of generalized hybrid mapping*, *J. Nonlinear Sci. Appl.*, **8** (2015), 354–362

¹DEPARTMENT OF MATHEMATICS
GOVERNMENT COLLEGE UNIVERSITY
LAHORE 54000, PAKISTAN

²CHINA MEDICAL UNIVERSITY
TAICHUNG, TAIWAN
Email address: abbas.mujaheed@gmail.com

³NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES, LAHORE CAMPUS
DEPARTMENT OF SCIENCES AND HUMANITIES
LAHORE, PAKISTAN
Email address: hira.iqbal@nu.edu.pk

⁴DEPARTMENT OF MATHEMATICS
QATAR UNIVERSITY
STATISTICS AND PHYSICS
DOHA 2713, QATAR
Email address: safeer@qu.edu.qa; safeerhussain5@yahoo.com