

A new type of contractions that characterize metric completeness

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ABSTRACT.

We prove that a new type of contractions characterizes the metric completeness of the underlying space. We also discuss the Meir-Keeler fixed point theorem.

REFERENCES

- [1] Banach, S., *Sur les opérations dans les ensembles abstraits et leur application aux équations intégrales*, Fund. Math., **3** (1922), 133–181
- [2] Berinde, V., *Some remarks on a fixed point theorem for Ćirić-type almost contraction*, Carpathian J. Math., **25** (2009), 157–162
- [3] Berinde, V. and Păcurar, M., *Fixed point theorems for nonself single-valued almost contractions*, Fixed Point Theory, **14** (2013), 301–311
- [4] Caristi, J., *Fixed point theorems for mappings satisfying inwardness conditions*, Trans. Amer. Math. Soc., **215** (1976), 241–251
- [5] Caristi, J. and Kirk, W. A., *Geometric fixed point theory and inwardness conditions*, Lecture Notes in Math., **490** Springer, Berlin, 1975, 74–83
- [6] Ćirić, L. B., *A generalization of Banach's contraction principle*, Proc. Amer. Math. Soc., **75** (1974), 267–273
- [7] Ćirić, L. B., *A new fixed-point theorem for contractive mappings*, Publ. Inst. Math. (Beograd), **30** (1981), 25–27
- [8] Ćirić, L. B., *Generalized contractions and fixed-point theorems*, Publ. Inst. Math. (Beograd), **12** (1971), 19–26
- [9] Connel, E. N., *Properties of fixed point spaces*, Proc. Amer. Math. Soc., **10** (1959), 974–979
- [10] Dhompongsa, S. and Yingtaeesittikul, H., *Fixed Point Theory Appl.*, (2009), Article ID 972395, 15 pages
- [11] Dugundji, J., *Positive definite functions and coincidences*, Fund. Math. **90** (1976), 131–142
- [12] Ekeland, I., *On the variational principle*, J. Math. Anal. Appl., **47** (1974), 324–353
- [13] Kannan, R., *Some results on fixed points II*, Amer. Math. Monthly, **76** (1969), 405–408
- [14] Kikkawa, M. and Suzuki, T., *Some similarity between contractions and Kannan mappings*, Fixed Point Theory Appl., (2009), Article ID 192872, 10 pages
- [15] Kikkawa, M. and Suzuki, T., *Three fixed point theorems for generalized contractions with constants in complete metric spaces*, Nonlinear Anal., TMA, **69** (2008), 2942–2949
- [16] Kirk, W. A., *Caristi's fixed point theorem and metric convexity*, Colloq. Math., **36** (1976), 81–86
- [17] Kirk, W. A., *Contractions mappings and extensions*, Handbook of metric fixed point theory (W. A. Kirk and B. Sims, Eds.), Kluwer Academic Publishers, Dordrecht, 2001, 1–34
- [18] Kirk, W. A., *Fixed point of asymptotic contractions*, J. Math. Anal. Appl., **277** (2003), 645–650
- [19] Kuczma, M., Choczewski, B. and Ger, R., *Iterative functional equation*, Encyclopedia of Mathematics and Applications, vol. **32**, Cambridge University Press, Cambridge, 1990
- [20] Jachymski, J., *Equivalent conditions and the Meir-Keeler type theorems*, J. Math. Anal. Appl., **194** (1995), 293–303
- [21] Meir, A. and Keeler, E., *A theorem on contraction mappings*, J. Math. Anal. Appl., **28** (1969), 326–329
- [22] Moţ, G. and Petruşel, A., *Fixed point theory for a new type of contractive multivalued operators*, Nonlinear Anal., TMA, **70** (2009), 3371–3377
- [23] Nadler, Jr., S. B., *Multi-valued contraction mappings*, Pacific J. Math., **30** (1969), 475–488
- [24] Park, S., *Characterizations of metric completeness*, Colloc. Math., **49** (1984), 21–26

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- [25] Popescu, O., *Two fixed point theorems for generalized contractions with constants in complete metric spaces*, Cent. Eur. J. Math., **7** (2009), 529–538
- [26] Popescu, O., *A new type of multivalued contractive operators*, Bull. Sci. Math., **137** (2013), 30–44
- [27] Reich, S., *Kannan's fixed point theorem*, Boll. Un. Mat. Ital., **4** (1971), 1–11
- [28] Rhoades, B., *A comparison of various definitions of contractive mappings*, Trans. Amer. Math. Soc., **226** (1977), 257–290
- [29] Singh, S. L. and Mishra, S. N., *Remarks on recent fixed point theorems*, Fixed Point Theory Appl., (2010), Article ID 452905, 18 pages
- [30] Singh, S. L., Pathak, H. K., Mishra, S. N., *On a Suzuki type general fixed point theorem with applications*, Fixed Point Theory Appl., (2010), Article ID 234717, 15 pages
- [31] Subrahmanyam, P. V., *Remarks on some fixed point theorems related to Banach's contraction principle*, J. Math. Phys. Sci., **8** (1974), 445–457
- [32] Subrahmanyam, P. V., *Completeness and fixed-points*, Monatsh. Math., **80** (1975), 325–330
- [33] Suzuki, T., *A generalized Banach contraction principle that characterizes metric completeness*, Proc. Amer. Math. Soc., **136** (2008), 1861–1869
- [34] Weston, J. D., *A characterization of metric completeness*, Proc. Amer. Math. Soc., **64** (1977), 186–188

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