

Dedicated to Prof. Billy E. Rhoades on the occasion of his 90<sup>th</sup> anniversary

## Fixed point results for single valued and set valued $P$ -contractions and application to second order boundary value problems

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### ABSTRACT.

In this paper, by considering the concept of set-valued nonlinear  $P$ -contraction which is newly introduced, we present some new fixed point theorems for set-valued mappings on complete metric space. Then by considering a single-valued case we provide an existence and uniqueness result for a kind of second order two point boundary value problem.

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### REFERENCES

- [1] Altun, I., Durmaz, G. and Olgun, M., *P*-contractive mappings on metric spaces, J. Nonlinear Funct. Anal., **2018** (2018), Article ID 43, pp. 1–7
- [2] Aydi, H. and Karapinar, E., *Fixed point results for generalized  $\alpha$ - $\psi$ -contractions in metric-like spaces and applications*, Electron J Differ Equ. **133** (2015), 1–15
- [3] Berinde, V. and Păcurar, M., *The role of the Pompeiu-Hausdorff metric in fixed point theory*, Creat. Math. Inform., **22** (2013), No. 2, 35–42
- [4] Feng, Y. and Liu, S., *Fixed point theorems for multivalued contractive mappings and multivalued Caristi type mappings*, J. Math. Anal. Appl., **317** (2006), 103–112
- [5] Fulga, A. and Proca, A., *A new generalization of Wardowski fixed point theorem in complete metric spaces*, Advances in the Theory of Nonlinear Analysis and its Applications, **1** (2017), No. 1, 57–63
- [6] Fulga, A. and Proca, A., *Fixed points for  $\varphi_E$ -Geraghty contractions*, J. Nonlinear Sci. Appl., **10** (2017), No. 9, 5125–5131
- [7] Hançer, H. A., *On multivalued P-contractive mappings that belongs to class of weakly Picard operators*, Fixed Point Theory (Cluj). Accepted.
- [8] Istrăţescu, V. I., *Fixed Point Theory an Introduction*, Dordrecht D. Reidel Publishing Company, 1981
- [9] Klim, D. and Wardowski, D., *Fixed point theorems for set-valued contractions in complete metric spaces*, J. Math. Anal. Appl., **334** (2007), 132–139
- [10] Mizoguchi, N. and Takahashi, W., *Fixed point theorems for multivalued mappings on complete metric spaces*, J. Math. Anal. Appl., **141** (1989), 177–188
- [11] Nadler, S. B., *Multi-valued contraction mappings*, Pacific J. Math., **30** (1969), 475–488
- [12] Popescu, O., *Fixed point theorem in metric spaces*, Bull. of Transilvania Univ., **1** (2008), 479–482
- [13] Reich, S., *Fixed points of contractive functions*, Boll. Un. Mat. Ital., **4** (1972), No. 5, 26–42
- [14] Saipara, P., Khammahawong, K. and Kumam, P., *Fixed-point theorem for a generalized almost Hardy-Rogers-type F contraction on metric-like spaces*, Math. Methods Appl. Sci., **42** (2019), No. 17, 5898–5919

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