Dedicated to Professor Yeol Je Cho on the occasion of his retirement

Some surjectivity results for operators of generalized monotone type via a topological degree

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Abstract.

We introduce a topological degree for a class of operators of generalized monotone type in reflexive Banach spaces, based on the recent Berkovits degree. Using the degree theory, we give some surjectivity results for operators of generalized monotone type in reflexive Banach spaces. In the Hilbert space case, this reduces to the celebrated Browder-Minty theorem for monotone operators.

Acknowledgments. This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2016R1D1A1B03931517).

REFERENCES

- Berkovits, J., On the degree theory for mappings of monotone type, Ann. Acad. Sci. Fenn. Ser. A 1 Math. Diss., 58 (1986), 1–58
- Berkovits, J., Extension of the Leray-Schauder degree for abstract Hammerstein type mappings, J. Differ. Equ., 234 (2007), 289–310
- [3] Browder, F. E., Nonlinear elliptic boundary value problems, Bull. Amer. Math. Soc., 69 (1963), 862-874
- [4] Browder, F. E., Fixed point theory and nonlinear problems, Bull. Amer. Math. Soc., 9 (1983), 1-39
- [5] Browder, F. E., Degree of mapping for nonlinear mappings of monotone type, Proc. Natl. Acad. Sci. U.S.A., 80 (1983), 1771–1773
- [6] Browder, F. E. and Ton, B. A., Nonlinear functional equations in Banach spaces and elliptic super-regularization, Math. Z., 105 (1968), 177–195
- [7] Hong, S.-J., Solvability of abstract hammerstein equations via topological degree, Master thesis, 2014
- [8] Kim, I.-S. and Hong, S.-J., A topological degree for operators of generalized (S₊) type, Fixed Point Theory Appl., (2015), Article ID 194, 16 pp.
- [9] Minty, G., On a monotonicity method for the solution of non-linear equations in Banach spaces, Proc. Natl. Acad. Sci. U.S.A., 50 (1963), 1038–1041
- [10] O'Regan, D., Cho, Y.-J and Chen, Y. Q., Topological Degree Theory and Applications, Chapman & Hall/CRC, Boca Raton, FL, 2006
- [11] Troyanski, S., On locally uniformly convex and differentiable norms on certain non-separable spaces, Studia Math., 37 (1971), 173–180
- [12] Zeidler, E., Nonlinear Functional Analysis and its Applications II/B : Nonlinear Monotone Operators, Springer, New York, 1990

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