## APPLICATION OF A THREE CRITICAL POINTS THEOREM FOR A CLASS OF INCLUSION PROBLEMS

## HANNELORE LISEI and IOANA LAZĂR

Abstract. In this paper we prove the existence of at least three solutions for a differential inclusion problem involving the p-Laplacian with nonhomogeneous and nonsmooth Neumann boundary conditions. We use a three critical points theorem for locally Lipschitz functions given by A. Kristály, W. Marzantowicz, Cs. Varga [7].

MSC 2010. 34A60, 47J20, 49J52.

**Key words.** Nonhomogeneous Neumann boundary condition, elliptic differential inclusions, critical points.

## REFERENCES

- CARL, S. and HEIKKILÄ, S., p-Laplacian inclusions via fixed points for multifunctions in posets, Set-Valued Anal., 16 (2008), 637–649.
- [2] CLARKE, F.H., Optimization and Nonsmooth Analysis, SIAM, Philadelphia, 1990.
- [3] DAI, G., Infinitely many solutions for a Neumann-type differential inclusion problem involving the p(x)-Laplacian, Nonlinear Anal., **70** (2009), 2297–2305.
- [4] DAI, G., Three solutions for a Neumann-type differential inclusion problem involving the p(x)-Laplacian, Nonlinear Anal., **70** (2009), 3755–3760.
- [5] DAI, G. and LIU, W., Three solutions for a differential inclusion problem involving the p(x)-Laplacian, Nonlinear Anal., **71** (2009), 5318–5326.
- [6] KRISTÁLY, A., Infinitely many solutions for a differential inclusion problem in  $\mathbb{R}^N$ , J. Differential Equations, **220** (2006), 511–530.
- [7] KRISTÁLY, A., MARZANTOWICZ, W. and VARGA CS., A non-smooth three critical points theorem with applications in differential inclusions. J. Global Optim., 46 (2010), 49–62.
- [8] LISEI, H. and VARGA, CS., Multiple solutions for a differential inclusion problem with nonhomogeneous boundary conditions, Numer. Funct. Anal. Optim., 30 (2009), 566–581.
- [9] MARANO, S. and MOTREANU, D., Infinitely many critical points of non-differentiable functions and applications to a Neumann-type problem involving the p-Laplacian, J. Differential Equations, 182 (2002), 108–120.
- [10] MARANO, S. and MOTREANU D., On a three critical points theorem for nondifferentiable functions and applications to nonlinear boundary value problems, Nonlinear Anal., 48 (2002), 37–52.
- [11] MOTREANU, D. and RĂDULESCU, V., Variational and non-variational methods in nonlinear analysis and boundary value problems. Nonconvex Optimization and its Applications, Kluwer Academic Publishers, Dordrecht, 2003.

Both authors were supported in their research by MEdC-ANCS, Grant PN II ID PCE 2008 Nr. 501/ ID 2162/ 2009.

[12] RICCERI, B., Minimax theorems for limits of parametrized functions having at most one local minimum lying in a certain set, Topology Appl., 153 (2006), 3308–3312.

Received October 9, 2009 Accepted December 3, 2009 "Babeş-Bolyai" University Faculty of Mathematics and Computer Science Str. Mihail Kogălniceanu Nr. 1 400084 Cluj-Napoca, Romania E-mail: hanne@math.ubbcluj.ro E-mail: lioana@math.ubbcluj.ro