

BIFURCATION TYPE PHENOMENA FOR POSITIVE SOLUTIONS OF NONLINEAR NEUMANN EIGENVALUE PROBLEMS

EVGENIA H. PAPAGEORGIOU

Abstract. We consider a parametric nonlinear problem driven by the p -Laplace differential operator and with a reaction which is p -superlinear near $+\infty$ but need not satisfy the usual in such cases Ambrosetti-Rabinowitz condition. Using critical point theory and truncation and comparison techniques, we prove a bifurcation-type theorem for such problems.

Mathematics subject classification (2010): 35J25, 35J80.

Keywords and phrases: p -superlinear reaction, bifurcation-type result, truncations, nonlinear maximum principle, Cerami condition, positive solution.

REFERENCES

- [1] S. AIZICOVICI, N.S. PAPAGEORGIOU, V. STAICU, *Existence and multiple solutions with precise sign information for superlinear Neumann problems*, Annali di Mat. Pura Appl., **188**, (2009), 679–719.
- [2] A. AMBROSETTI, H. BREZIS, G. CERAMI, *Combined effects of concave and convex nonlinearities in some elliptic problems*, Journal of Functional Analysis, **122** (1994), 519–543.
- [3] A. AMBROSETTI, G. AZORERO, P. ALONSO, *Multiplicity of solutions for semilinear and quasi-linear elliptic problems*, Journal of Functional Analysis, **137** (1996), 219–242.
- [4] J.G. AZORERO, J.J. MANFREDI, I.P. ALONSO, *Sobolev versus Hölder local minimizer and global multiplicity for some quasilinear elliptic equations*, Commun. Contemp. Math., **2** (2000), 385–404.
- [5] F. BROCK, L. ITURIAGA, P. UBILLA, *A multiplicity result for the p -Laplacian involving a parameter*, Ann. Henri Poincaré, **9** (2008), 1371–1386.
- [6] D. COSTA, C. MAGALHAES, *Existence results for perturbations of the p -Laplacian*, Nonlin. Anal., **24** (1995), 409–418.
- [7] M. DELGALO, A. SUAREZ, *On the structure of the positive solutions of the logistic equation with nonlinear diffusion*, J. Math. Anal. Appl. **268** (2002), 200–216.
- [8] W. DONG, *A priori estimates and existence of positive solutions for a quasilinear elliptic equation*, J. London Math. Soc., **72** (2005), 645–662.
- [9] G. FEI, *On periodic solutions of superquadratic hamiltonian systems*, Electron. J. Differential Equations, **08** (2002), 1–12.
- [10] L. GASINSKI, N.S. PAPAGEORGIOU, *Bifurcation type results for nonlinear parametric elliptic equations*, Proc. Royal Soc. Edinburgh **142A** (2012), 1–29.
- [11] Z. GUO, *Some existence and multiplicity results for a class of quasilinear elliptic eigenvalue problems*, Nonlinear Anal., **18** (1992), 957–971.
- [12] Z. GUO, Z. ZHANG, *$W^{1,p}$ versus C^1 local minimizers and multiplicity results for quasilinear elliptic equations*, J. Math. Anal. Appl., **286** (2003) 32–50.
- [13] S. HU, N.S. PAPAGEORGIOU, *Multiple positive solutions for nonlinear eigenvalue problems with p -Laplacian*, Nonlin. Anal., **69** (2008), 4286–4300.
- [14] S. HU, N.S. PAPAGEORGIOU, *Multiplicity of solutions for parametric p -Laplacian equations with nonlinearity concave near the origin*, Tohoku Math. J., **62** (2010), 137–162.
- [15] S. HU, N.S. PAPAGEORGIOU, *Nonlinear Neumann equations driven by a nonhomogeneous differential operator*, Commun. Pure Appl. Anal., **9** (2010), 1801–1827.
- [16] L. JEANJEAN, *On the existence of bounded Palais-Smale sequences and application to a Landesman-Lazer type problem set on R^N* , Proc. Roy. Soc. Edinburgh, **129A** (1999), 787–809.

- [17] G. LIEBERMANN, *Boundary regularity for solutions of degenerate elliptic equations*, Nonlin. Anal., **12** (1988), 1203–1220.
- [18] C. MAYA, R. SHIVAJI, *Multiple positive solutions for a class of semilinear elliptic boundary value problems*, Nonlin. Anal., **38** (1999), 497–504.
- [19] O.H. MIYAGAKI, M.A. SOUTO, *Superlinear problems without Ambrosetti and Rabinowitz growth condition*, J. Differential Equations, **245** (2008) 3628–3638.
- [20] D. MOTREANU, V. MOTREANU, N.S. PAPAGEORGIOU, *Nonlinear Neumann problems near resonance*, Indiana Univ. Math. J., **58** (2009), 1257–1279.
- [21] D. MOTREANU, N.S. PAPAGEORGIOU, *Existence and multiplicity of solutions for Neumann problems*, J. Differential Equations, **232** (2007), 1–35.
- [22] D. MOTREANU, N.S. PAPAGEORGIOU, *Multiple solutions for nonlinear Neumann problems driven by a nonhomogeneous differential operator*, Proc. Amer. Math. Soc., **139** (2011), 3527–3535.
- [23] N.S. PAPAGEORGIOU, S. KYRITSI, *Handbook of Applied Analysis*, Springer, New York, 2009.
- [24] K. PERERA, *Multiple positive solutions for a class of quasilinear elliptic boundary-value problems*, Electron. J. Differential Equations, **07** (2003), 1–5.
- [25] P. RABINOWITZ, *Variational methods for nonlinear elliptic eigenvalue problems*, Indiana Univ. Math. J., **23** (1973/74), 729–754.
- [26] M. SCHECHTER, W. ZOU, *Superlinear problems*, Pacific J. Math., **214** (2004) 145–160.
- [27] S. TAKEUCHI, *Multiplicity result for a degenerate elliptic equation with logistic reaction*, J. Differential Equations, **173** (2001), 138–144.
- [28] X. WU, L. CHEN, *Existence and multiplicity of solutions for elliptic equations involving the p -Laplacian*, NoDEA **15** (2008), 745–755.
- [29] J. VAZQUEZ, *A strong maximum principle for some quasilinear elliptic equations*, Appl. Math. Optim. **12** (1984), 191–202.