

GLOBAL CURVE OF POSITIVE SOLUTIONS FOR ϕ - LAPLACIAN DIRICHLET BVP WITH AT MOST ONE TURNING POINT

ABDELHAMID BENMEZAI, SALIMA MECHROUK AND SOTIRIS K. NTOUYAS

Abstract. Under suitable conditions we prove that the set of positive solutions to the ϕ -Laplacian boundary value problem

$$-(\phi(u'))' = \lambda f(u) \text{ in } (0, 1); u(0) = u(1) = 0,$$

where $\lambda > 0$ is a real parameter, ϕ is an odd increasing homeomorphism of \mathbb{R} and $f \in C([0, +\infty), [0, +\infty))$, consists on a curve $\|u\| \rightarrow \lambda(\|u\|)$.

Mathematics subject classification (2010): 34B15, 34B16.

Keywords and phrases: second order bvp, positive solution, global curve.

REFERENCES

- [1] I. ADDOU, F. AMMAR KHODJA, *Sur le nombre de solutions d'un probleme aux limites non lineaire*, C. R. Acad. Sci. Paris, **321**, Serie 1 (1995), pp. 409–412.
- [2] I. ADDOU AND A. BENMEZAI, *Exact number of positive solutions for a class of quasilinear boundary value problems*, Dynam Systems Appl., **8** (1999), 147–180.
- [3] I. ADDOU AND A. BENMEZAI, *Boundary-value problems for the one-dimensional p -Laplacian with even superlinearity*, Electron. J. Diff. Eqns., Vol. 1999, No. 9, (1999), 1–29.
- [4] I. ADDOU, A. BENMEZAI, S. M. BOUGUIMA AND M. DERHAB, *Exactness results for generalized Ambrosetti-Brezis-Cerami problem and related one-dimensional elliptic equations*, Electron. J. Diff. Eqns., Vol. 2000, No. 66 (2000), pp. 1–34.
- [5] A. AMBROSETTI, *On the exact number of positive solution of convex nonlinear problem*, Boll. Unione Mat. Ital. A, **15** (1978), 610–615.
- [6] A. AMBROSETTI AND P. HESS, *Positive solutions of asymptotically linear elliptic eigenvalue problems*, J. Math. Anal. Appl., **73** (1980), 411–422.
- [7] A. BENMEZAI, *Complete description of the solution set to a strongly nonlinear O.D.E.*, E. J. Qualitative Theory of Diff. Equ., **9** (2003), 1–18.
- [8] A. BENMEZAI, *Positive solutions for a second order two point boundary value problem*, Communication in Applied Analysis, **14**, 2 (2010), 177–190.
- [9] A. BENMEZAI, S. DJEBALI, T. MOUSSAOUI, *Positive solution for ϕ -Laplacian Dirichlet bvps*, Fixed Point Theory, **8** (2007), 167–186.
- [10] A. BENMEZAI, S. DJEBALI, T. MOUSSAOUI, *Multiple positive solution for ϕ -Laplacian Dirichlet bvps*, PanAmer. Math. J., **17** (2007), 53–73.
- [11] A. CASTRO, S. GADAM, R. SHIVAJI, *Evolution of positive solution curve in semi-positone problems with concave nonlinearities*, J. Math. Anal. Appl., **245** (2000), 282–293.
- [12] C. DE-COSTER, *Pairs of positive solutions for the one-dimensional p -Laplacian*, Nonlinear Anal., **23** (1994), 669–681.
- [13] D. DE-FIGUEIREDO, *Positive solutions of semilinear elliptic problems*, Lecture Notes in Math., **957** (1982), 34–87.
- [14] H. DANG, K. SCHMITT, R. SHIVAJI, *On the number of solutions of bvp involving p -Laplacian*, Electron. J. Diff. Eqns., Vol. 1996, 1 (1996), 1–9.
- [15] P. DE MOTTONI, A. TESEI, *On a class of non linear eigenvalue problems*, Boll. Unione Mat. Ital. B, **14** (1977), 172–189.

- [16] T. DING AND F. ZANOLIN, *Time maps for the solvability of periodically perturbed nonlinear Duffing equations*, *Nonlinear Anal.*, **17**, 7 (1991), 635–653.
- [17] GARCÍA-HUIDOBRO M., R. MANÁSEVICH, J.R. WARD, *Positive solutions for equations and systems with p -Laplace-like operators*, *Advances in Differential Equations*, Vol. **14**, 5-6 (2009), 401–432.
- [18] M. GARCÍA-HUIDOBRO, R.F. MANÁSEVICH, F. ZANOLIN, *A Fredholm-like result for strongly nonlinear second order O.D.E.'s*, *J. Differential Equations*, **114** (1994), 132–167.
- [19] M. GARCÍA-HUIDOBRO, R.F. MANÁSEVICH, F. ZANOLIN, *On a pseudo Fučík spectrum for strongly nonlinear second order O.D.E.'s and an existence result*, *J. Comput. Appl. Math.*, **52** (1994), 219–239.
- [20] M. GARCÍA-HUIDOBRO, R.F. MANÁSEVICH, F. ZANOLIN, *Strongly nonlinear second order O.D.E.'s with rapidly growing terms*, *J. Math. Anal. Appl.*, **202** (1996), 1–26.
- [21] M. GARCÍA-HUIDOBRO, P. UBILLA, *Multiplicity of solutions for a class of nonlinear second-order equations*, *Nonlinear Anal.*, **28** (1997), 1509–1520.
- [22] Y.X. HUANG, *Existence of positive solutions for a class of the p -Laplace equations*, *J. Austral. Math. Soc. Ser. B*, **36** (1994), 249–264.
- [23] P.F. HSIEH, Y. SIBUYA, *Basic theory of ordinary differential equations*, Springer-Verlag, 1999.
- [24] H.G. KAPER, M. KNAPP, M.K. KWONG, *Existence theorems for second order bvps*, *Diff. Int. Eqns.*, **4** (1991), 543–554.
- [25] H.B. KELLER, D.S. COHEN, *Some positive problems suggested by nonlinear heat generation*, *J. Math. Mech.*, **16** (1967), 1361–1376.
- [26] P. KORMAN, Y. LI, *Generalized averages for solutions of two point Dirichlet problem*, *J. Math. Anal. Appl.*, **239** (1999), 478–484.
- [27] P. KORMAN, T. OUYANG, *Exact multiplicity results for a class of boundary-value problems with cubic nonlinearities*, *J. Math. Anal. Appl.*, **194** (1995), 328–341.
- [28] P. KORMAN, Y. LI, *On the exactness of an S-shaped bifurcation curve*, *Proc. Amer. Math. Soc.*, **127** (1999), 1011–1020.
- [29] T. LAETSCH, *The number of solutions of a nonlinear two point bvp*, *Indiana Univ. Math. J.*, **20** (1970) 1–13.
- [30] R. MANÁSEVICH, F. I. NJOKU AND F. ZANOLIN, *Positive solutions for the one-dimensional p -Laplacian*, *Diff. Int. Eqns.*, **8** (1995), 213–222.
- [31] R. MANÁSEVICH AND F. ZANOLIN, *Time mappings and multiplicity of solutions for the one-dimensional p -Laplacian*, *Nonlinear Anal.*, **21**, 4 (1993), 269–291.
- [32] F. I. NJOKU, F. ZANOLIN, *Positive solutions for the two point BVP's: Existence and multiplicity results*, *Nonlinear Anal.*, **13** (1989), 1329–1338.
- [33] Z. OPIAL, *Sur les solutions périodiques de l'équation différentielle $x'' + g(x) = p(t)$* , *Bulletin de l'académie Polonaise des sciences, Série des sci. math., astr. et phys.* Vol. **VIII**, No. 3, 1960.
- [34] B. P. RYNNE, *A global curve of stable positive solutions for a p -Laplacian problem*, *Electron. J. Diff. Eqns.*, Vol. 2010, 58 (2010), 1–12.
- [35] P. UBILLA, *Multiplicity results for the 1-dimensional generalized p -Laplacian*, *J. Math. Anal. Appl.*, **190** (1995), 611–623.