Existence and uniqueness of solution for a class of superlinear Kirchhoff-type equations on the real half-line

ISHAK KETTAF AND SOFIANE KHOUTIR

ABSTRACT. This paper is concerned with a class of Kirchhoff-type equations on the real half-line. By using the Mountain Pass theorem, we show the existence and uniqueness of solution in the case where f is a superlinear function. Our results improve and extend a recently published ones.

ACKNOWLEDGMENTS

REFERENCES

[1] Alves C.O., Correa F.J.S.A. On existence of solutions for a class of problem involving a nonlinear operator. *Comm. Appl. Nonlinear Anal.* **8**(2001), no. 2, 43–56.

[2] Ambrosetti A., Rabinowitz P.H. Dual variational methods in critical point theory and applications. *J. Funct. Analysis.***14**(1973), 349–381.

[3] Arcoya D., Carmona J., Martinez-Aparicio P.J. Multiplicity of solutions for an elliptic Kirchhoff equation. *Milan J. Math.* **90**(2022), no. 2, 679–689.

[4] Arosio A., Panizzi S. On the well-posedness of Kirchhoff string. *Transactions Amer. Math. Soc.***348**(1996), 305–330.

[5] Brezis H. *Functional analysis, Sobolev spaces and partial differential equations*. Spring Science & Business Media, 2010.

[6] Boulaiki H., Moussaoui T., Precup R. Positive solutions for second-order differential equations of Kirchhoff type on the half-line. *Carpathian J. Math.* **37** (2021), no. 2, 325–338.

[7] Cheng B., Li G., Tang X.H. Nehari-type ground state solutions for Kirchhoff type problems in $\mathbb{R}^N$. *Appl. Anal.***98**(2019), no. 7, 1255–1266.

[8] Del Pino M., Felmer P. Local mountain passes for semilinear elliptic problems in unbounded domains.*Calc. Var. Partial Differential Equations***4**(1996), 121–137.

[9] Furtado M.F., Silva E.D., Severo U.B. Kirchhoff elliptic problems with asymptotically linear or superlinear nonlinearities. *Z. Angew. Math. Phys.***71**(2020), no. 186, 1–18.

[10] Heidarkhani S., Afrouzi G.A., Moradi S. Existence results for a Kirchhoff-type second-order differential equation on the half-line with impulses. *Asymptot. Anal.***105**(2017), no. 3-4, 137–158.

[11] Ikoma N. Existence of ground state solutions to the nonlinear Kirchhoff type equations with potentials. *Discrete Contin. Dyn. Syst.* **35**(2015), no. 3, 943–966.

[12] Kirchhoff G. *Vorlesungen uber Mechanik Vorlesungen ueber mathematische Physik: Mechanik*. Teubner, Leipzig 1876.

[13] Khoutir S. Existence of ground state solution for a class of one-dimensional Kirchhoff-type equations with asymptotically cubic nonlinearities. *J. Elliptic Parabol. Equ.***9**(2023), no. 1, 155-69.

[14] Khoutir S., Chen H.: Multiple nontrivial solutions for a nonhomogeneous Schrödinger–Poisson system in R^3. *Electron. J. Qual. Theory Differ. Equ.***28**(2017), 1—17.

[15] Lions J.L. On some questions in boundary value problems of mathematical physics. *North-Holland Mathematics Studies.***30**)(1978), 284–346.

[16] Meng X., Zeng X. Existence and asymptotic behavior of minimizers for the Kirchhoff functional with periodic potentials.*J. Math. Anal. Appl.* **507**(2022), no. 1, 125727.

[17] Precup R., Stan A. Stationary Kirchhoff equations and systems with reaction terms. *AIMS Mathematics.* **7**(2022) , no. 8, 15258–15281.

[18] Rzymowski W.: One-dimensional Kirchhoff equation. *Nonlinear Anal.* **48**(2002), 209–221.

[19] Sun J., Wu T. On the Kirchhoff type equations in $\mathbb{R}^N$. *Adv. Differential Equations***27**(2022), no. 3-4, 97–146 (2022)

[20] Wu Y., Huang Y., Liu Z. On a Kirchhoff type problem in $\mathbb{R}^N$. *J. Math. Anal. Appl.***425**(2015), 548–564.

[21] Silva E.D., Silva J.S. Ground state solutions for asymptotically periodic nonlinearities for Kirchhoff problems. *Commun. Pure Appl. Anal.* **21**(2022), no. 9, 2933–2963.

[22] Willem M. *Minimax Theorems.* Birkhäuser, Boston 1996.

[23] Wu K., Zhou F. Nodal solutions for a Kirchhoff type problem in $\mathbb{R}^N$. *Appl. Math. Lett.* **88**(2019), 58–63.

FACULTY OF MATHEMATICS
AMNEDP LABORATORY
USTHB, PB 32 EL-ALIA, BAB EZZOUAR 16111, ALGIERS, ALGERIA
Email address: ikettaf@usthb.dz
Email address: skhoutir@usthb.dz