

LYAPUNOV–TYPE INEQUALITIES FOR DIFFERENTIAL EQUATION INVOLVING ONE–DIMENSIONAL MINKOWSKI–CURVATURE OPERATOR

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Abstract. In this paper, some new Lyapunov-type inequalities for one-dimensional Minkowski-curvature equation with anti-periodic and Sturm-Liouville boundary conditions are presented.

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REFERENCES

- [1] A. M. LYAPUNOV, *Probleme général de la stabilité du mouvement*, (French Translation of a Russian paper dated 1893), Ann. Fac. Sci. Univ. Toulouse 2 (1907) 27–247 (Reprinted as Ann. Math. Studies, No. 17, Princeton Univ. Press, Princeton, NJ, USA, 1947).
- [2] RUI YANG, INBO SIM, YONG-HOON LEE, *Lyapunov-type inequalities for one-dimensional Minkowski-curvature problems*, Applied Mathematics Letters, **91** (2019) 188–193.
- [3] A. AZZOLLINI, *Ground state solution for a problem with mean curvature operator in Minkowski space*, J. Funct. Anal. 266 (2014) 2086–2095.
- [4] A. AZZOLLINI, *On a prescribed mean curvature equation in Lorentz-Minkowski space*, J. Math. Pures Appl. 106 (2016) 1122–1140.
- [5] C. BEREANU, P. JEBELEAN, J. MAWHIN, *Radial solutions for some nonlinear problems involving mean curvature operators in Euclidean and Minkowski spaces*, Proc. Amer. Math. Soc. 137 (2009) 161–169.
- [6] C. BEREANU, P. JEBELEAN, P. J. TORRES, *Multiple positive radial solutions for a Dirichlet problem involving the mean curvature operator in Minkowski space*, J. Funct. Anal. 265 (2013) 644–659.
- [7] C. BEREANU, P. JEBELEAN, P. J. TORRES, *Positive radial solutions for Dirichlet problems with mean curvature operators in Minkowski space*, J. Funct. Anal. 264 (2013) 270–287.
- [8] C. BEREANU, J. MAWHIN, *Existence and multiplicity results for some nonlinear problems with singular ϕ -Laplacian*, J. Differential Equations 243 (2007) 536–557.
- [9] D. BONHEURE, P. D’AVENIA, A. POMPONIO, *On the electrostatic Born-Infeld equation with extended charges*, Comm. Math. Phys. 346 (2016) 877–906.
- [10] I. COELHO, C. CORSATO, F. OBERSNEL, P. OMARI, *Positive solutions of the Dirichlet problem for the one-dimensional Minkowski-curvature equation*, Adv. Nonlinear Stud. 12 (2012) 621–638.
- [11] I. COELHO, C. CORSATO, S. RIVETTI, *Positive radial solutions of the Dirichlet problem for the Minkowski-curvature equation in a ball*, Topol. Methods Nonlinear Anal. 44 (2014) 23–39.
- [12] C. CORSATO, F. OBERSNEL, P. OMARI, S. RIVETTI, *Positive solutions of the Dirichlet problem for the prescribed mean curvature equation in Minkowski space*, J. Math. Anal. Appl. 405 (2013) 227–239.
- [13] S. B. ELIASON, *Lyapunov type inequalities for certain second order functional differential equations*, SIAM J. Appl. Math., 27 (1) (1974) 180–199.
- [14] B. G. PACHPATTE, *On Lyapunov-type inequalities for certain higher order differential equations*, J. Math. Anal. Appl., 195 (2) (1995), 527–536.

- [15] N. PARHI, S. PANIGRAHI, *On Liapunov-Type Inequality for Third-Order Differential Equations*, J. Math. Anal. Appl., 233 (2) (1999) 445–460.
- [16] A. TIRYAKI, M. UNAL, D. ÇAKMAK, *Lyapunov-type inequalities for non-linear systems*, J. Math. Anal. Appl., 332 (2007), 497–511.
- [17] S. PANIGRAHI, *Liapunov-type integral inequalities for certain higher-order differential equations*, Electr. J. Diff. Equat., 2009, No. 28, pp. 1–14.
- [18] D. ÇAKMAK, *Lyapunov-type integral inequalities for certain higher order differential equations*, Appl. Math. Comput. 216 (2010) 368–373.
- [19] M. F. AKTAS, D. ÇAKMAK, *Lyapunov-type inequalities for third-order linear differential equations*, Electr. J. Diff. Equat., 2017 (2017), No. 139, pp. 1–14.
- [20] S. K. NTOUYAS, B. AHMAD AND T. P. HORIKIS, *Recent developments of Lyapunov-type inequalities for fractional differential equations*, In: D. Andrica, T. Rassias (eds.), *Differential and Integral Inequalities*, Springer Optimization and Its Applications, 151, Springer, Cham, (2019).
- [21] Q. MA, C. MA AND J. WANG, *A Lyapunov-type inequality for a fractional differential equation with Hadamard derivative*, J. Math. Inequal., 11 (1) (2017), 135–141.
- [22] Z. LAADJAL, N. ADJEROUD, Q. MA, *Lyapunov-type inequality for the Hadamard fractional boundary value problem on a general interval $[a, b]$* , J. Math. Inequal., 13 (3) (2019), 789–799.
- [23] Y. WANG, Q. WANG, *Lyapunov-type inequalities for fractional differential equations under multi-point boundary conditions*, J. Math. Inequal., 13 (3) (2019), 611–619.
- [24] Y. WANG, S. LIANG, C. XIA, *A Lyapunov-type inequality for a fractional differential equation under Sturm-Liouville boundary conditions*, Math. Inequal. Appl., 20 (1) (2017), 139–148.
- [25] T. ABDELJAWAD, F. JARAD, S. F. MALLAK, AND J. ALZABUT, *Lyapunov type inequalities via fractional proportional derivatives and application on the free zero disc of Kilbas-Saigo generalized Mittag-Leffler functions*, Eur. Phys. J. Plus (2019) 134: 247.