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Periodic and subharmonic solutions of generalized Lazer-Solimini equation

Jana Burkotová*

Abstract

The aim of the contribution is to investigate the singular nonlinear differential equation of the second order known as the generalized Lazer–Solimini equation

$$x'' + g(x) = p(t).$$

The nonlinearity g has a singularity at $x = 0$ and p is a continuous periodic function. Besides classical positive periodic solutions, the so-called bouncing solutions have been studied, i.e. solutions that collide with the singularity with the elastic impact condition $x'(t+) = -x'(t-)$ if $x(t) = 0$.

The case of attractive weak singularity of g is considered in [1] and [2] where sufficient conditions for the coexistence of classical periodic solutions and periodic bouncing and subharmonic bouncing solutions are derived. For numerical simulations, the technique introduced in [3] for state-dependent impulsive boundary value problems is discussed. The idea of the method is based on the shooting approach with a combination of Newton iterations.

The talk is based on the joint work with Irena Rachůnková, Jakub Stryja, Jan Tomeček (Czech Republic) and Winfried Auzinger, Victor Wenin (Austria).

References

[1] J. Tomeček, I. Rachůnková, J. Burkotová, J. Stryja, *Coexistence of bouncing and classical periodic solutions of generalized Lazer–Solimini equation*, Nonlinear Analysis **196** (2020), 111783.

[2] J. Tomeček, V. Krajščáková, *Subharmonic bouncing solutions of generalized Lazer*, Electron. J. Qual. Theory Differ. Equ. **63** (2021), 1–11.

[3] W. Auzinger, J. Burkotová, I. Rachůnková, V. Wenin, *Shooting methods for state-dependent impulsive boundary value problems, with applications*, Applied Numerical Mathematics, **128** (2018), 217-229.

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* Department of Mathematical Analysis and Application of Mathematics, Faculty of Science, Palacký University Olomouc, 17. listopadu 12, 771 46 Olomouc, Czech Republic, jana.burkotova@upol.cz.