LOSSY TRANSMISSION LINES TERMINATED BY NONLINEAR R-LOADS - PERIODIC REGIMES

V. G. ANGELOV

Dedicated to Professor Ioan A. Rus on the occasion of his 70th birthday

University of Mining and Geology "St. I. Rilski"

Department of Mathematics, 1700 Sofia, Bulgaria

E-mail: angelov@mgu.bg

Abstract. The paper is devoted to the analysis of lossy transmission lines terminated by nonlinear R-loads whose V-I characteristic is approximated by polynomials. By means of fixed point method conditions for the existence of periodic solutions are formulated. A complete exposition of reducing of the mixed problem for lossy transmission lines to an initial value problem for a neutral functional differential equation on the boundary is presented. An example demonstrates the applicability of the method.It is shown of how to choose the relations between basic quantities in the process of analysis and design of the transmission lines.

Key Words and Phrases: lossy transmission lines, nonlinear R-load, polynomial nonlinearities, fixed point theorem.

2000 Mathematics Subject Classification: 94C05, 34K40, 47H10

References

[1] V.E. Abolinia, A.D. Myshkis, *Mixed problem for almost linear hyperbolic systems in the plane*, Matem. Sbornik, **50(92)**, (1960), 423-442 (in Russian).

[2] V.G. Angelov, *Fixed point theorems in uniform spaces and applications*, Czechoslovak Math. Journal, **37**(1987), 19-33.

[3] V.G. Angelov, *Transmission lines terminated by series nonlinear RLC - loads*, Annual of the University of Architecture, Civil Engineering and Geodesy, Sofia, **41**, (2000-2001), 9-29.

[4] R.K. Brayton, *Bifurcation of periodic solutions in a nonlinear difference - differential equations of neutral type*, Quarterly of Applied Mathematics, **24**(1966), 215-224.

[5] R.K. Brayton, *Nonlinear oscillations in a distributed network*, Quarterly of Applied Mathematics, **24**, (1967), 289-301.

[6] K.L. Cooke, D.W. Krumme, *Differential - difference equations and nonlinear initial boundary value problems for linear hyperbolic partial differential equations*, J. Math. Anal. Appl., **24**(1968), 372-387.

[7] V.N. Damgov, *Nonlinear and Parametric Phenomena in Radiophysical Systems*, "Prof. M. Drinov" Academic Publishing House, Sofia 2000.

[8] N. Danford, J. Schwartz, *Linear Operators, I,* General Theory, Nescience Publishers, Inc., New York, 1964.

[9] N. Dodov, *Compatibility and measurement of the parameters of antenna - feeder devices*, Technics, Sofia, 1984 (in Bulgarian).

[10] L.E. Elsgolz, S.B. Norkin, *Introduction to the theory of differential equations with deviated arguments*, Nauka, Moscow, 1971 (in Russian).

[11] S.K. Godunov, *Equations of Mathematical Physics*, Nauka, Moscow, 1979 (in Russian).

[12] Y.M. Grigoriev, S.N. Eremeev, V.V. Naumov, A.A. Semenov, *Analysis of current and voltage waves induced by lightening in cable lines*, X Int. Wroczlaw Symposium on Electromagnetic Compatibility, (1990), 247-250 (in Russian).

[13] J.K. Hale, S.M. Verduyn Lunel, *Introduction to functional differential equations*, Springer-Verlag, 1993.

[14] S.A. Maas, *Nonlinear Microwave Circuits,* Artech House, 1988.

[15] A.D. Myshkis, *Linear differential equations with retarded arguments*, Nauka, Moscow, 1972 (in Russian).

[16] Y. Nagumo, M. Shimura, *Self-oscillation in a transmission line with a funnel diode*, Proc. IRE, **49**(1961), 1281-1291.

[17] B.N. Sadovskii, *Limit compact and densifying operators*, Uspekhi Mat. Nauk, **27**(1972), 81-146 (in Russian).

[18] M. Shimura, *Analysis of some nonlinear phenomena in a transmission line*, IEEE Transactions on Circuit Theory, **14**(1967), 60-68.

[19] J. Wu, H. Xia, *Self-sustained oscillations in a ring array of coupled lossless transmission lines*, J. Differential Equations, **124**(1996), 247-278.