S6-P-021201

# DEPENDENCE OF THE OSCILLATIONS FREQUENCY IN A NONLINEAR TRANSMISSION LINE WITH SATURATED FERRITE ON MAGNETIC FIELDS AND LINE DIMENSIONS

*O.O. MUTYLIN[1], P.V. PRIPUTNEV[1], I.V. ROMANCHENKO[1], V.P. TARAKANOV[1,2,3]*

*[1]Institute of high current electronics SB RAS, Tomsk, Russian federation*
*[2]Joint Institute for High Temperatures, Moscow, Russian Federation*
*[3]National Research Nuclear University MEPhI, Moscow, Russian Federation*

The study and development of nonlinear transmission lines (NLTLs) has been going on for several decades. Initially, NLTLs were used for high-voltage pulse sharpening. The best results have been achieved in ferrite-filled lines [1]. The use of lines with saturated ferrite filling made it possible to increase the voltage rise rate and obtain rise times of tens of picoseconds [2]. The results of further studies have shown that in NLTL with saturated ferrite, it is possible to efficiently excite high-frequency oscillations with central frequency of a few GHz at power level of hundreds of MW [3].

In the course of experiments on the excitation of high-frequency oscillations in the NLTL with saturated ferrite, it was shown that the frequency of the excited oscillations in the line depends on the strength of the magnetic fields in which the process of pulsed magnetization reversal of the ferrite filling occurs. It was found that an increase in the frequency of the excited oscillations corresponds to an increase in the azimuthal component of the magnetic field strength, while the frequency decreases with an increase in the strength of the longitudinal magnetic field saturating ferrite. However, to date, it is not possible to determine all the factors that affect the frequencies of excited oscillations in an NLTL, since today there is no analytical model for describing this process that considers non-TEM modes, and experimental study is too expensive.

The solution to this problem can be the use of numerical simulation to conduct a numerical experiment on the process of excitation of oscillations in the NLTL [4,5]. This work is devoted to the determination of the main factors affecting the frequency of excited oscillations in the NLTL with saturated ferrite. The influence of the magnetic field strengths, the coefficient of ferrite transverse filling, and the transverse dimensions of the line on the frequency and efficiency of the excited oscillations was studied.

REFERENCES

[1] J.E. Dolan, H.R. Bolton, A.J. Shapland, “Development of ferrite line pulse sharpeners”, proc. IEEE Int. Pul. Pow. Conf., pp. 795-798, Jun. 1993.

[2] M.R. Ulmaskulov, S.A. Shunailov, K.A. Sharypov, M.I. Yalandin, “Modification of high-voltage pulse waveform by the spiral and core-transformer fierrite-filled lines”, IEEE trans. Plas. Sci., vol. 45, no. 10, pp. 2707-2714, Oct. 2017.

[3] V.V. Rostov, N.M. Bykov, D.N. Bykov, A.I. Klimov, O.B. Kovalchuk, I.V. Romanchenko, “Generation of subgigawatt RF pulses in nonlinear transmission lines”, IEEE Trans. Plasma Sci., vol. 38, no. 10, pp. 2681-2685, Oct 2010

[4] V.P. Tarakanov, “Multipurpose electromagnetic code KARAT”, Math. Mod.”: prob. and res., pp. 456-476, 2003.

[5] P.V. Priputnev, I.V. Romanchenko, V.P. Tarakanov, I.V. Pegel “2-D and 3-D numerical simmulation of ferrite loaded coaxial transmission lines”, 2020 7th International Congress on Energy Fluxes and Radiation Effects (EFRE), Sep. 2020.