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Nonlinear distortion effects of the probing signal in the diagnostics and control of feeders of the radio astronomy systems

In modern space studies on board of the spacecrafts at operation of antenna systems and systems of communication and control a number of problems associated with the transmission of signals in the proper circuits takes place, that directly affects not only the correct work of the equipment, but also the quality and representativeness of obtained experimental information. We have developed a method of the construction of diagnostic equipment that can be efficient for detecting both single and multiple combinational defects with a sufficiently high accuracy, which is based on a proposed echo-location diagnostic technique. The essence of the method is use of a probing signal in the form of sequentially formed harmonic oscillations of several different frequencies with further common processing of received reflected signals. On the basis of this method the possibilities of improving the qualitative indices of the diagnostic equipment are considered. Nevertheless, at diagnostics and control of feeders of radio-astronomical systems by use of the method of the synthesized video signal there are number of questions, for example such as a possibility of due accounting of the nonlinear effects in communication lines of complex geometry with multiple combinational defects. Besides, it should be noted that existence of the dispersion in the communication line leads to distortion of the original waveform of a signal at its propagation, and degree of influence of distortions increases with the removal of the defects from the beginning of the communication line. Thereby, the presence of dispersion is one of the limiting factors. So, the distortions increase with distance increasing and at decreasing of frequency. Thus, the accounting for nonlinear and dispersion effects enables us to consider more general case. The solution of this problem in studies of propagation of the probing synthesized video signal is based on using of the model constructed on the basis of set of KdV-class equations for long communication lines with nonlinear elements. At this, one can observe some effects, such as the dispersion of the propagating current and voltage pulses with time, and formation of high-frequency sequences of the stable soliton-like structures, and also a phenomenon of parametric amplification of a signal.

Biography

Dr. Ludmila Yu. Fadeeva, PhD (Devices and Methods of Control). Main fields: theory and numerical simulation in the electrodynamics, radio waves, radio engineering, construction of diagnostic equipment, diagnostics and control of communication lines and antenna system. Presently, she is Associate Professor and deputy Dean at the Kazan National Research Technical University named after A. N. Tupolev – KAI.

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