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SYNTHESIS OF LINEAR EQUALIZERS BY THE SIMPLE ITERATION METHOD

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The paper describes a new method for "blind" smoothing of nonlinear distortion in communication channels represented by Volterra's filters. Compensation of the channel nonlinearity is performed based on the simple iteration algorithm. The results obtained are compared with the results of processing by the high-order inverse and by the method of fixed point.

The toughening of requirements to information reception quality has led to the necessity in synthesis of highly accurate methods of compensation of signal distortion in wire and wireless communication channels. One of the important factors, constraining the operation of satellite, radio, telephone, and other channels, consists in nonlinear distortion caused by the presence, in the communication systems, of amplifiers operating near the saturation domain.

To eliminate the undesirable distortion effect, special equalizers (compensators, correctors, etc.) are used whose methods of synthesis fall in two categories. The first one includes methods of compensation of communication channel nonlinearity by means of Volterra's filtration: methods of high-order inverse [1, 2], methods of roots of the Volterra equation [3], and the method of fixed point [4]. The second category corresponds to methods of synthesis of equalizers in the form of perceptron [5], radial [6], and recurrent [7] neural networks. The difference between the two categories is that in the case of Volterra's filtering we deal with the "blind" synthesis of equalizers (without usage of test signals and procedure of identification of the device parameters) while synthesis of equalizers as neural networks includes the "learning" of the device.

The Volterra filtering methods are of importance in "many-users" communication systems, when it is desirable to synchronize the receiver with the received signal, and to adjust the equalizer without the learning sequence. The methods based on the neural network theory should be used when the communication channel characteristics are a priori unknown or vary with time. Particularly, the equalizers are designed in such a way as to respond to the channel characteristics and, in the event of their variations, to adapt to this variation.

In this work we suggest a highly accurate "blind" method of equalizer construction based on simple iterations used in the Volterra functional model of a communication channel.

Formulation and treatment of the nonlinear compensation problem. The equalizer, which compensates the channel nonlinearity at the reception side of a communication system, will be called "postfilter", while the equalizer performing a similar operation at the transmission side will be called the "prefilter". The functional diagrams illustrating connection of the communication channel with the postfilter and prefilter are shown in Fig. 1*a*, *b*, respectively. Here $H = \sum_{k=1}^{N} H_k$ is the nonlinear operator of the channel filter, where H_k is the *k*th order operator, H_{post} is the nonlinear operator of the postfilter-equalizer, and H_{pre} is the nonlinear operator of the prefilter-equalizer.

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