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RECONSTRUCTION OF ACOUSTIC FULL WAVEFORMS USING ARTIFICIAL NEURAL NETWORKS

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A b s t r a c t

A successful application of Artificial Neural Network (ANN) to reconstructing acoustic waveforms is presented. During processing the acoustic full waveforms the authors met incorrectly recorded signals. Greater amplitudes of the second waveform (recorded by the far receiver) disable, among others, the proper determination of attenuation of elastic waves in rock formation. To reconstruct the second waveform on the basis of the first one (recorded by the near receiver) two feed-forward neural networks with different number of neurons in hidden layer were used. The networks were trained using Conjugate Gradient and Back Propagation methods, using different sets of training coefficients η and momentum α. The training, verifying and testing sets were formed by pairs of acoustic waveforms recorded by Long Spaced Sonic device. The amplitudes of *P* waves taken from signals recorded by the near receiver were used as the input, whereas the output data came from the far receiver wavetrains.

The artificial neural networks were trained on the two data sets: the first one – pairs of recorded waveforms, and the second one – pairs of waveforms with corrected time shift of the far signals in relation to the near ones. Data correction substantially improved network operation: from about 21% signals reconstructed faultlessly (when the best ANN was trained on the recorded data set) to about 59% (trained on the corrected one).

Key words: well logging, acoustic wavetrains, artificial neural network.