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The use of artificial neural network to design and fabricate one of the most compact microstrip diplexers for broadband L-band and S-band wireless applications

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Abstract

In this paper, a computational intelligence method based on artificial neural network (ANN) is used to design and fabricate a high-performance microstrip diplexer. For a novel basic bandpass filter we have developed an ANN model with S-parameters and group delay (GD) as the outputs and frequency, substrate type, substrate thickness and physical dimensions as the inputs. Using the multilayer perceptron neural network trained with back-propagation algorithm, a novel microstrip diplexer with a very small area of $0.004 \lambda_g^2$ is obtained. It has the insertion losses less than 0.1 dB and GDs less than 1 ns, which are the best values in comparison with the previously reported microstrip diplexers. The proposed diplexer operates at 1.4 GHz and 3 GHz for L-band and S-band wireless applications, respectively. It has two wide fractional bandwidths of 47% and 45% which make it appropriate for broadband applications. Moreover, the very low insertion losses of the presented diplexer make it suitable for energy harvesting applications. The designed diplexer can attenuate the 1st up to 7th harmonics, where several transmission zeros are obtained that improve the stopband features. To verify the design process, the ANN model and simulation results, the presented diplexer is fabricated and measured.

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