Parametric Fault Detection of Analogue Circuits Based on Optimized Support Vector Machine Classifier

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Abstract

Parametric faults in analogue circuits cause system performance degeneration and are hard to be detected. There are no clear boundaries between fault-free and faulty circuit output due to components tolerances. Therefore, a machine learning classifier needs to be learned to correctly classify circuit outputs. In this paper, the parametric fault detection method of analogue circuits based on the support vector machine (SVM) classifier is developed. The proper choice of kernel parameters for the SVM in the training process improves the classification accuracy. The penalty parameter and kernel function parameters for the radial basis function (RBF) kernel should be optimized. In addition, the Bayesian optimization methodology is used to select the hyperparameters for the SVM classifier. The Biquad filter, one of the benchmark circuits, is utilized to validate the proposed method and compare it with the other methods. Using downside minimum size detectable fault (DMSDF) and upside minimum size detectable fault (UMSDF) values, the method gives good enhancements in detecting faults due to minor changes in components values above or down the nominal component values.

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