

1: CiteSeerX Citation Query Fault Testing and Diagnosis in Combinational Digital Circuits

Fault Diagnosis Of Digital Circuits Section 2 electrical circuits autoshop , electrical circuit diagnosis course 2 1 a circuit is a complete path for current when voltage is applied there are three basic.

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Abstract This paper presents a novel fault diagnosis method for analog circuits using ensemble empirical mode decomposition EEMD , relative entropy, and extreme learning machine ELM. First, nominal and faulty response waveforms of a circuit are measured, respectively, and then are decomposed into intrinsic mode functions IMFs with the EEMD method. Next, a feature vector is obtained for each faulty circuit. Finally, an ELM classifier is trained with these feature vectors for fault diagnosis. Via validating with two benchmark circuits, results show that the proposed method is applicable for analog fault diagnosis with acceptable levels of accuracy and time cost.

Introduction Numerous researches have indicated that analog circuit fault diagnosis is a significant fundamental for design validation and performance evaluation in the integrated circuit manufacturing fields [1 – 3]. In contrast to the well-developed diagnostic methods for digital circuits, diagnosis for analog circuits is an extremely difficult problem and an active research due to the following reasons: The procedure of fault diagnosis for analog circuits can be generally classified into four stages: As one of the foremost stages in fault diagnosis, feature extraction methods are closely related to the efficiency of fault diagnosis. Many feature extraction methods have been proposed such as correlation function technique [4], information entropy approach [5], the fast Fourier transform technique [6], and the wavelet transform technique [7]. Aminian proposed a diagnostic method of analog circuits using wavelet decomposition coefficients, principal component analysis PCA , and data normalization to construct fault feature vectors and then trained and tested neural network classifiers [3]. The method can obtain higher accuracy of diagnosis. In [9], Long et al. For information entropy techniques, it is more sensitive to parameter variations of components in CUTs. Therefore, information entropy is widely used with other techniques for fault diagnosis [5 , 10 – 12]. In [11], authors have developed a new fault diagnosis approach by using kurtosis and entropy of sampled signals as feature vectors to train a neural network classifier. However, there are some problems which should be considered and solved in feature extraction. Firstly, how to select features to train classifiers should be considered because different features with different classifiers for analog fault diagnosis have different results. Secondly, we find that most of the aforementioned methods were validated with some discrete simulations data. It means this method has low fault coverage. Thirdly, some methods should take the influence of tolerance and the continuity of faulty parameters into account. In our work, therefore, we use the techniques of EEMD, kurtosis, and relative entropy to construct new feature vectors to train an ELM classifier to improve the diagnosability and reduce time cost. As an adaptive time frequency data analysis method ensemble empirical mode decomposition EEMD is suitable for linear, nonlinear, and non-stationary signals [13]. Recently, it has been successfully applied to extract significant fault features in many fields such as rotating machinery and locomotive roller bearings fault diagnosis [13 – 15]. Relative entropy method is rarely used in the analog circuit fault diagnosis field. The difference between the probability distributions of faulty and fault-free circuits can be distinguished clearly by adopting relative entropy, because when a component is varied, the energy distribution is also changed which leads to change in relative entropy. Kurtosis is a measure of heavy tailed distribution of a real valued random variable. It can clearly describe the difference from waveforms. As a result, the combinational methods of kurtosis and relative entropy are suitable as fault features for analog fault diagnosis. As a consequence, in this paper, we decomposed impulse responses of a CUT into IMFs using EEMD method and then adopting kurtosis and relative entropy techniques to obtain feature vectors. These feature vectors can be used for diagnosis of faulty components among various variation possibilities. For this purpose, a classifier is needed. We selected extreme learning machine ELM classifier because it is proven to have excellent generalization performance and low computational cost [16 , 17] when it is fed to train and test with fault features. Utilizing the combination of EEMD, relative entropy,

and ELM algorithms for feature extraction and classification we can complete analog circuit fault diagnosis. It demonstrates reliable and accurate fault diagnosis with reduced test time. This paper is organized as follows: In Section 3, the diagnostic procedure of the proposed method is introduced. Section 4 shows the simulation experiment details and results for two benchmark analog circuits. And then the performance of the proposed method is also discussed in the Section. Finally the conclusions are drawn in Section 5. Based on simple assumption any signal consists of different simple intrinsic modes of oscillations from low to high frequency [13, 19]. Thus, original signal is defined as where is the intrinsic mode functions IMF. An IMF is defined as a simple oscillatory function that satisfies two conditions [18]: From 1, we can see that the original signal is decomposed into IMFs and one residue. The procedure of decomposition with shifting method is described as follows. Given a signal, all local maxima and minima of it are gained firstly. Then upper and lower envelopes of the given signal are determined from a cubic spline interpolation of the local maxima and minima. Let be the mean of the two envelopes and the first component is obtained as.

2: How to use Digital Multimeter correctly for diagnosis a circuit fault? - Yantra

Hence the proposed system is an intelligent virtual diagnosis system with good diagnosis ability for the hard fault diagnosis with parametric variations in the digital circuits. This work further can be extended to experimental validation of fault diagnosis using circuit hardware.

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3: Fault Diagnosis for Analog Circuits by Using EEMD, Relative Entropy, and ELM

Aiming to provide comprehensive coverage of all aspects of fault diagnosis in the digital circuits, this study focuses on the use of up-to-date on-line testing techniques for digital devices employed.

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