信号处理 2011, 27(4) 624-628 DOI: ISSN: 1003-0530 CN: 11-2406/TN

短文与研究通讯

基于模糊C均值聚类算法与隶属算法的容差电路软故障诊断

黄亮 侯建军 骆丽

北京交通大学电子信息工程学院

摘要：

在聚类分析与隶属函数的基础上，提出了一种容差电路软故障诊断的新算法。对于含有容差元件的的模拟电路，由于允许电路参数在一定范围内偏离理想值，所以很难判断电路是处于正常容差状态，还是软故障状态。本文首先简述了模糊C均值（Fuzzy C-means, FCM）聚类算法与模糊控制隶属算法的基本原理。然后通过一个容差电路软故障诊断实例，以验证本文算法的有效性：首先确定容差电路的正常状态与软故障状态种类，对每一种状态进行电路仿真，获取将来进行聚类分析与故障诊断的样本。然后对采集样本进行聚类分析，利用模糊C均值聚类算法将各种状态分类，并且得到所有状态的聚类中心。最后随机模拟一种电路状态，利用模糊隶属算法，计算当前电路状态与各状态聚类中心的隶属度，判断电路处于哪一种工作状态，实现容差电路的软故障诊断。实例表明，本文算法能够准确清晰地辨别容差电路的正常状态与故障状态，仅需少量样本即可获得各种状态的典型参数，对容差电路进行客观有效的软故障诊断。

关键词： 模拟电路； 故障诊断； 聚类分析； 容差； 模糊C均值； 模糊控制；隶属算法

Soft Fault Diagnosis of Analog Circuits with Tolerance Based on Fuzzy C-means Clustering Algorithm and Membership Algorithm

HUANG Liang, HOU Jian-Jun, LUO Li

School of Electronic and Information Engineering, Beijing Jiaotong University

Abstract:

To diagnose the soft fault of analog circuits with tolerance, an innovative arithmetic based on fuzzy C-means clustering analysis and fuzzy membership function is presented. Because there is the tolerance in analog circuits containing several the tolerance components, such as resistors and capacitors, the parameter of analog circuits with tolerance is permitted to depart the ideal parameter partly. It is very difficult to distinguish the normal tolerance state and the soft fault states. Firstly, the basic theory of fuzzy C-means (FCM) clustering algorithm and membership algorithm of fuzzy control is summarized. Secondly, a soft fault diagnosis example of analog circuit with tolerance is provided to verify the validity of our algorithm: Firstly, the classes of the normal tolerance state and the soft fault states are defined in analog circuits with tolerance. Multisim software is used to simulate the normal state and the soft fault states of analog circuits with tolerance and get the enough samples that needed by future clustering analysis and fault diagnosis. Secondly, samples are analyzed by clustering algorithm. Fuzzy C-means clustering algorithm is applied to classify the normal state and the soft fault states of analog circuits with tolerance; clustering centers are obtained by fuzzy C-means clustering algorithm. Clustering center is the typical parameter of the normal tolerance state and the soft fault states of analog circuit with tolerance. Finally, a random state is simulated in Multisim software. Fuzzy membership algorithm is used to calculate the membership between current state and clustering centers, judge the state of analog circuits with tolerance, diagnose the fault of analog circuits with tolerance. The result shows that this method can classify the normal state and fault states of analog circuits with tolerance accurately, obtain the typical parameter of every state using small samples, diagnose the soft fault of analog circuits with tolerance objectively and effectively.

Keywords: analog circuit fault diagnosis clustering analysis tolerance FCM fuzzy control membership algorithm

收稿日期 2010-04-09 修回日期 2011-01-10 网络版发布日期 2011-04-25

DOI:

基金项目:

国家自然科学基金（编号：60976024）

通讯作者:

作者简介:
作者Email: huangl@bjtu.edu.cn

参考文献：

本刊中的类似文章

文章评论

反馈人		邮箱地址	
反馈标题		验证码	5669