A Technique to Aggregate Classes of Analog Fault Diagnostic Data Based on Association Rule Mining

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ABSTRACT

▸ Analog circuits are widely used in different fields such as medicine, military, aviation and are critical for the development of reliable electronic systems.

▸ Testing and diagnosis are important tasks which detect and localize defects in the circuitunder test as well as improve quality of the final product.

▸ Outputresponses of fault-free and faulty behavior of analog circuit canbe represented by infinite set of values due to tolerances ofinternal components.

▸ The data mining methods may improvequality of fault diagnosis in the case of big data processing.

▸ The technique of aggregation the classes of fault diagnosticresponses, based on association rule mining, is proposed.

CONTD...

- Thetechnique corresponds to the simulation before test concept:a fault dictionary is generated by collecting the coefficients ofwavelet transformation for fault-free and faulty conditions as thepreprocessing of output signals.

- Classificator is based onk-nearestneighbors method (k-NN) and association rule mining algorithm.

- The fault diagnostic technique was trained and tested using dataobtained after simulation of fault-free and faulty behavior of theanalog filter.

- In result the accuracy in classifying faulty conditionsand fault coverage have consisted of more than 99,09% andmore than 99,08% correspondingly.

- The proposed technique iscompletely automated and can be extended.

EXISTING SYSTEM

‣ Nowadays, manufacturing of analog and mixed-signal in-tegrated circuits are developed very actively.

‣ Testing andfault diagnostics for such kind of integrated circuits (IC) areessentially more complex in comparison with digital IC dueto the following features:

‣ Continuous character of analogsignals processing;

‣ Nonlinearity and complex functionaldependence between the input and output signals;

‣ Influenceof component tolerance on the value of output signals;

‣ High sensitivity of output functions to the deviation of internalcomponent parameters and external environmental parameters;

‣ The lack of effective models for defects and faults for analog circuits, etc.

CONTD...

- Traditionally, diagnostics of analog circuits are implemented using which here on will be referred as Fault Dictionary (FD), each row of which contains the upper and lower boundaries of the range of possible values for controlled parameters in different test nodes for all considered states of the circuit,

- i.e.fault-free and faulty states containing different kinds of faults.

- Fault detection occurs during the output response measurement of the circuit-under-test (CUT) and sequential comparison value is obtained within the boundaries in FD rows.

- The condition of the CUT is diagnosed when the measured value lays in the boundary range of the corresponding row in FD.

PROPOSED SYSTEM

- The technique to construct the generalization fault dictionary based on artificial neural network taking into account the component tolerances and using the association rule mining as the preprocessing of a big volume of overlapped data which is proposed in the paper.

- Proposed technique reduces complexity of fault detection due to associative mode of operation as well as decreases the high size of the FD thanks to implementation of the FD as artificial neural network with fixed architecture for different number of considered faults.

- Algorithms which are used in this technique are parallel and ready to run on the clusters.

HARDWARE REQUIREMENTS

- Processor – Pentium –III
- Speed – 1.1 Ghz
- RAM – 256 MB(min)
- Hard Disk – 20 GB
- Floppy Drive – 1.44 MB
- Key Board – Standard Windows Keyboard
- Mouse – Two or Three Button Mouse
- Monitor – SVGA

SOFTWARE REQUIREMENTS

- Operating System : Windows 8
- Front End : Java /DOTNET
- Database : Mysql /HEIDISQL

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CONCLUSION

- The technique of construction for the classifier for analog fault testing and diagnosis was done by using the extraction of the essential characteristics based on wavelet transformation, Monte-Carlo method, association rules mining algorithms, and machine learning algorithm.

- The proposed technique helps to produce the high reliable analog and mixed-signals integrated circuits. The experimental verification of the prediction quality was performed on the most widely used filter topologies.

- The results obtained for the Sallen-Key filter demonstrate the high precision of prediction (>99,09%) and fault coverage(>99,08%) in the task of fault diagnostics. The proposed technique uses algorithms which were parallel and prepared to handle the big data obtained in result of the exhaustive simulation of analog circuits.

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