Chapter 12
Lecture 13
Chips J. Myers

Circuits

Automatic Test Generation for Combinational

Introduction

\[ 1 - \lambda_1 - \lambda_2 = D_L \]

- The defect level \( D_L \) is the fraction of defective parts.
- Let \( \lambda_1 \) be the fraction of faults covered by a test.
- Let \( \lambda_2 \) be the fraction of fail-free products.

A Short-Circuit (Stuck-at-0 Fault)

Testing Methods

Structural testing

- Verify all specific faults are present in the CNT.
- Knowledge of the structure of the CNT is essential.
- Based on assumed fault set.

Functional testing

- Verify all patterns are expected.
- No assumptions about structure of circuit under test (CUT).
- Few assumptions about failure mechanisms and faults.
Equivalent Rules

Stuck-at Rules

Extension and Sensitization

Extension and Sensitization
6. Choose one signal not reachable from fault site and assign to it.
5. If failure consists of one gate only, perform result backtracking.
4. If the funnel is empty, backtrack and go to step 2.
3. If the fault symptoms have reached a primary output:
   - Perform the implications of the last assignment.
   - Apply the funnel excitation condition.

ATPG Algorithm

Decision Tree for Previous Example

Schröder's Example

ATPG I Example
Example of Backtrace

A Redundant Circuit

Putting the Pieces Together

**D-graph: Algorithm:** Always select primary input using backtrace.
- **FAF Algorithm:** Select branch points of head-trees.
  - Select unassigned input to an unfulfilled gate.
  - Select unassigned input to a fanout gate.

**Choice of the Decision Variables**

Repeat until fault list is exhausted.
- Use fault simulation to detect which faults detected.
- If fault is unsuitable, discard it.
- Pick a fault from list and generate a test for it.
- Identify equivalent faults and select representative.
- Generate all possible faults.
A 2-bih Carry-Skip Adder

Previous circuit with a New Redundancy Removed

Circuit for Problem 4

Summary

Demonstrated how ATPG tools can detect redundancies
Decided a ATPG algorithm
Discussed various fault models