

TURBO TESTER

Test Software Package

DATE 05

Maksim Jenihhin

Department of Computer Engineering
1918
TALLINNA TEHNIKAÜLIKOOL
TALLINN UNIVERSITY OF TECHNOLOGY

enterprise estonia
ettevõttearendamine ja tootmine

Outline

- What is TURBO TESTER?
- TURBO TESTER Environment
 - Model Synthesis
 - Test Generation
 - BIST Simulation
 - Test Pattern Analysis
 - Test Set Optimization
 - Design Error Diagnosis
- Live Example
- Web-based Interface
- Conclusion

2

What is TURBO TESTER?

It is a test software package for VLSI circuits

- ✓ Freeware!
- ✓ It is used by hundreds of institutions in over 35 countries since 1997
- ✓ Compatible with Cadence, Synopsys, Mentor Graphics, Viewlogic, Compass, OrCAD, etc.

3

What is TURBO TESTER?

TURBO TESTER versions are available for:

- ✓ MS Windows OS
- ✓ Linux OS
- ✓ Solaris OS

TURBO TESTER **Graphical User Interface** is Java based, what makes it platform independent.

4

Application Field

- ✓ **Education**
VLSI, System Design courses
Laboratory works
- ✓ **Training**
System-on-Chip, Networks-on-Chip
technology engineers
- ✓ **Research**
Development and analysis of new
DFT approaches

5

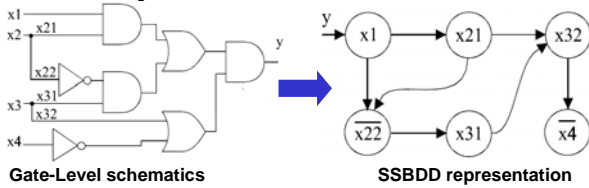
TURBO TESTER Environment

```

    graph TD
      Design[Design] --> TestGen[Test Generation]
      Design --> BIST[BIST Simulation]
      Design --> DesignErr[Design Error Diagnosis]
      TestGen --> TestSet[Test Set]
      BIST --> TestSet
      TestSet --> FaultSim[Fault Simulation]
      TestSet --> TestOpt[Test Set Optimization]
      TestOpt --> FaultTable[Fault Table]
      FaultTable --> FaultSim
      FaultTable --> DefectLib[Defect Library]
      FaultSim --> HazardData[Hazard Analysis Data]
      FaultSim --> DefectLib
      Design --> FaultyArea[Faulty Area]
      FaultyArea --> DesignErr
      DesignErr --> TestGen
      DesignErr --> BIST
      DesignErr --> TestOpt
  
```

6

Model Synthesis



All tools of TURBO TESTER (TT) use

Structurally Synthesized Binary Decision Diagrams (SSBDD).

TURBO TESTER includes interface to generate SSBDDs in AGM format from EDIF netlists.

The set of supported technology libraries is easily extendable.

7

Test Generation

ATPG algorithms:

- ✓ Random
- ✓ Deterministic (PODEM algorithm)
- ✓ Genetic (uses test vector mutations)
- ✓ (Mixed TPG strategies can also be investigated)

Tests can be generated for both:

- ✓ Combinational
- ✓ Sequential (random)

Generation is available at:

- ✓ BDD-level (increase in productivity)
- ✓ Gate-level
- ✓ RTL (hierarchical generator)

Fault models:

- ✓ Stuck-at
- ✓ Physical Defects

8

Built-In Self-Test Simulation

Built-In Self Test (BIST) approach applications:

- ✓ Built-In Logic Observer (BILBO)
- ✓ Circular Self-Test Path (CSTP)
- ✓ Hybrid BIST
 - deterministic test patterns applied after the pseudorandom ones in order to cover the hard to test faults and/or shorten the final Test Set
- ✓ Reseeding BIST (Store-and-Generate)
 - the whole test sequence is generated on the basis of stored test vectors

The self-test quality of different BIST architectures can be evaluated.

A TURBO TESTER tool implies genetic search algorithm for finding good BIST architectures.

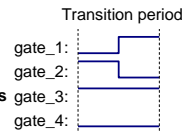
9

Test Pattern Analysis

Analysis methods:

- ✓ Fault simulation for sequential circuits
- ✓ Fault simulation for combinational circuits
 - Stuck-at faults
 - Defect-oriented simulation uses a special defect library (includes "short-fault"; "open-fault" soon)
- ✓ Multi-valued simulation for hazard analysis

- Models possible hazards of logic circuits
- 5- or 8-valued alphabets (i.e. {"1"; "0"; rising- ; falling transitions; hazards})
- representing logic network behavior waveforms



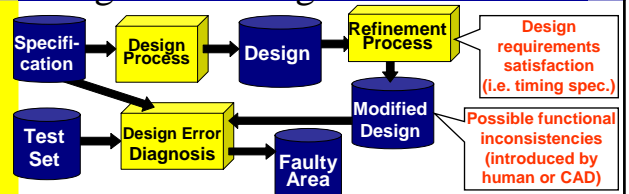
10

Test Set Optimization

- ✓ The TURBO TESTER tool minimizes number of test patterns by means of static compaction
- ✓ Preprocessing step for determining the essential vectors
- ✓ Application of implication and Greedy search algorithm
- ✓ Fast performance (run time)

11

Design Error Diagnosis



Design Error Diagnosis should be applied after the Modified Design verification

- It locates and corrects an error

TURBO TESTER uses SSBDD for both Design and Modified Design

- no need for special diagnostic test
- uses normal Test Set

12

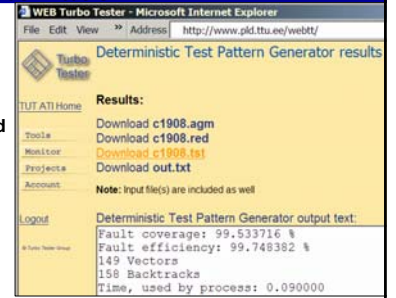
Live Example



13

Web-based Interface

- ✓ Web-based TURBO TESTER has the same functionality as the standalone one
- ✓ All tasks are performed on remote server machine
- ✓ User can work with existing benchmarks or upload his/her own designs
- ✓ Always the latest version of the software
- ✓ Personal user settings and history are stored on the server



URL: <http://www.pld.ttu.ee/WebTT>

14

User Documentation

TURBO TESTER installation includes a comprehensive reference manual:

- ✓ The manual is constantly updated
- ✓ The documentation complies with IEEE standard Std_1063-1987
- ✓ User support is constantly available by means of Internet



15

Development Team

Prof. Raimund Ubar
Jaani Raik
Elmet Orasson
Artur Jutman
Gert Jervan
Margit Aarna
Eero Ivask
Sergei Devadze
Vladislav Vislogubov
Maksim Jenihhin



Department of Computer Engineering
1918
TALLINNA TEHNIKAÜLIKOOL
TALLINN UNIVERSITY OF TECHNOLOGY

Official website:
<http://www.pld.ttu.ee/TT>

16