VLSI Testing
積體電路測試

Logic Simulation

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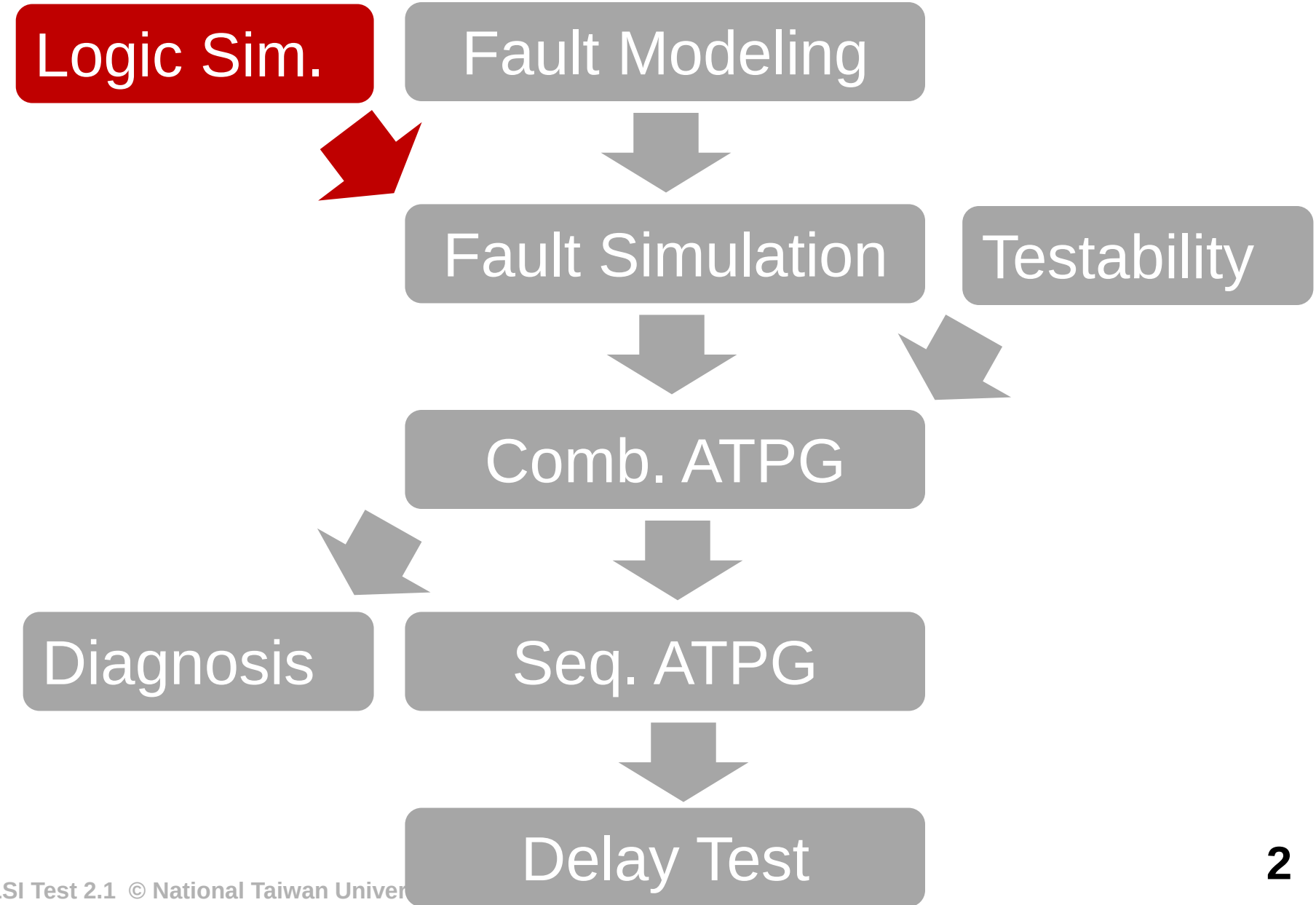
Course Roadmap (EDA Topics)



Why Am I Learning This?

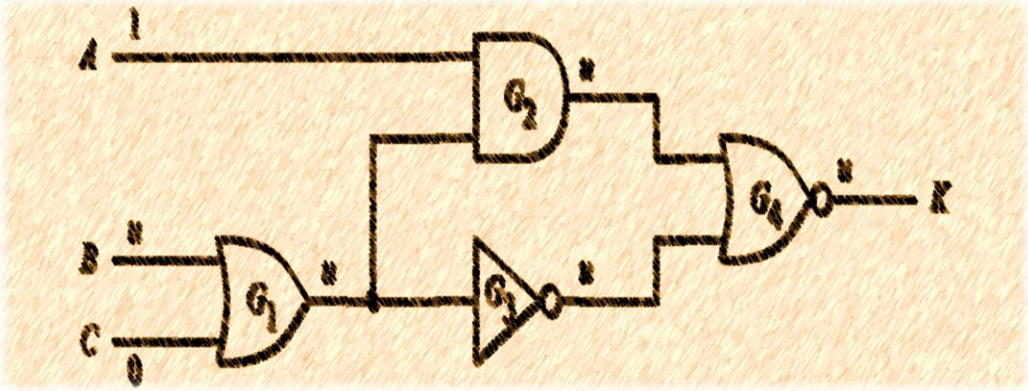
- Logic simulation is essential to verify our
  - Design correctness
  - ATPG patterns
- Logic simulation is basic EDA tool for digital circuits
  - Basic building block of many tools

"Logic is the anatomy of thought."

(John Locke)

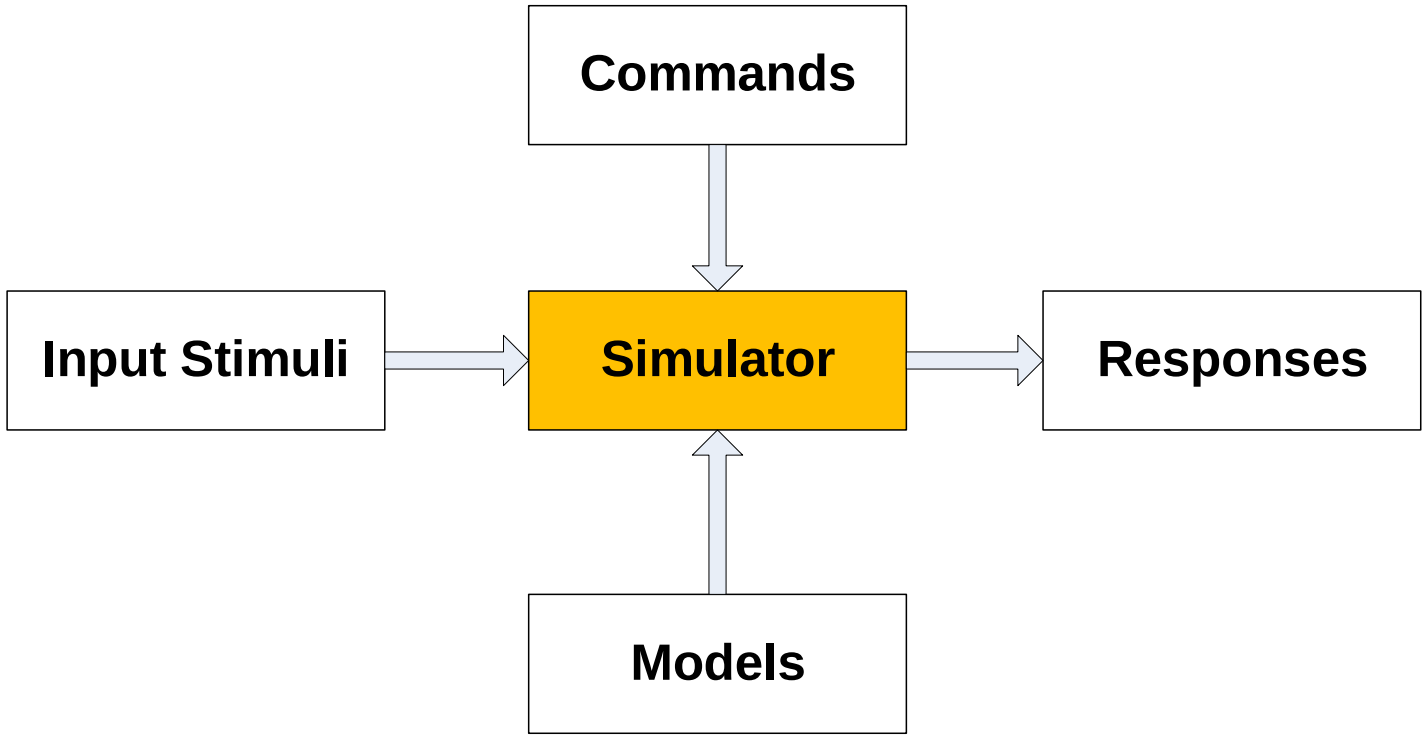
Logic Simulation

- **Introduction**
- **Simulation Models**
- **Logic Simulation Techniques**
- **Issues of Logic Simulations**
- **Conclusions**



What Is Simulation?

- Given input stimuli, models, and commands
  - Run software to produces output responses
- For digital circuits:
  - Input stimuli are *test patterns*
  - Models can be functional/logic/transistors (next slide)

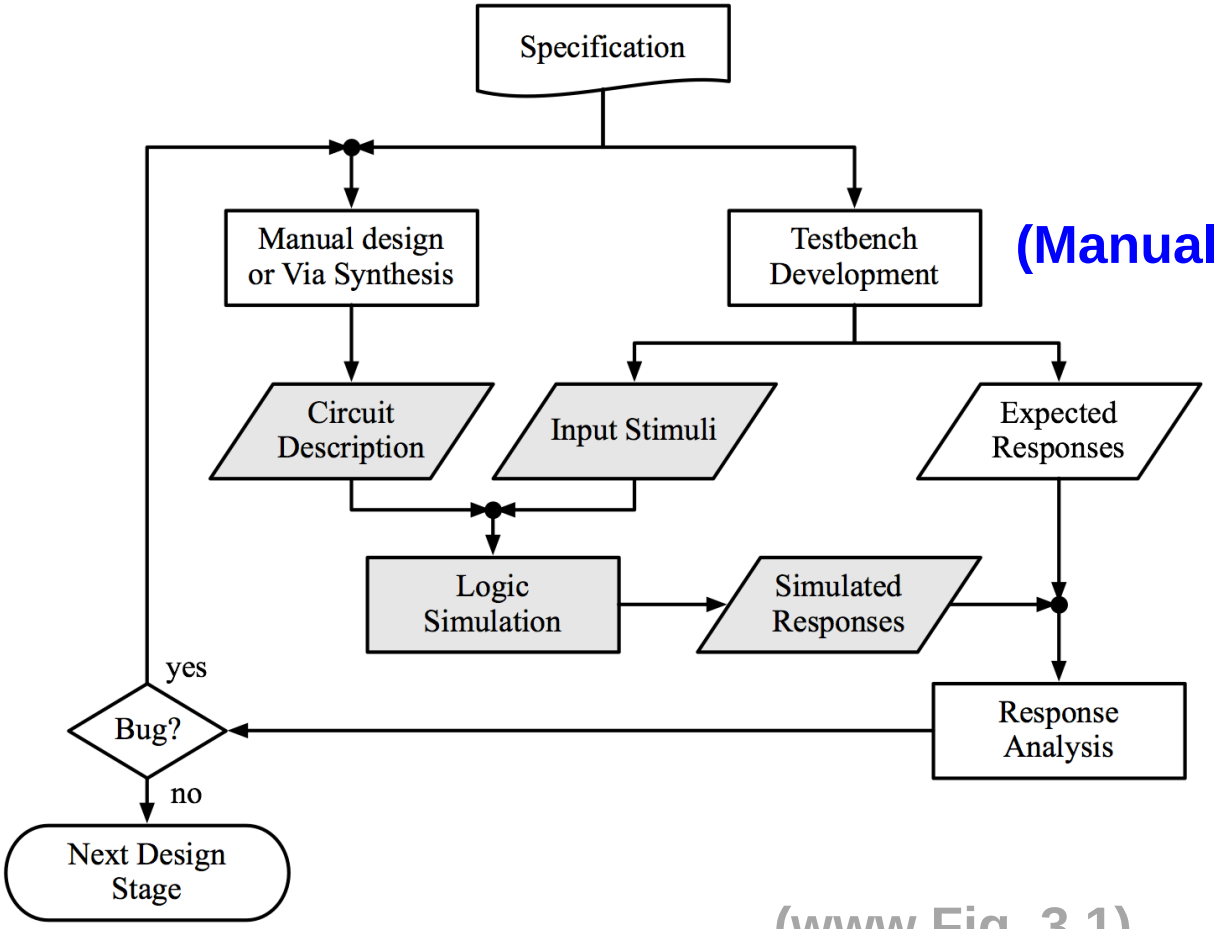


Levels of Circuit Simulation

- *Functional/Behavior level*
  - Interconnect of modules (expressed in programming language)
  - Good for architecture and functional verification
  - Fast but inaccurate
  - Example: C, System-C, Verilog (Register-Transfer-Level, RTL)
- *Logic level* ← focus of this chapter
  - Interconnect of Boolean gates (aka. *Gate-level netlist*): AND, OR, NOT …
  - Good for logic verification, test pattern generation
  - Example: Verilog (gate-level)
- *Transistor level*
  - Interconnect of transistors
  - Good for analog/mixed-signal and timing critical digital circuits
  - Slow but accurate
  - Example: SPICE
- *Mixed-level*
  - Mixed functional/logic/transistor levels
  - Trade off CPU time and accuracy

Verification by Simulation

- 1. Verify design correctness
- 2. Verify ATPG patterns

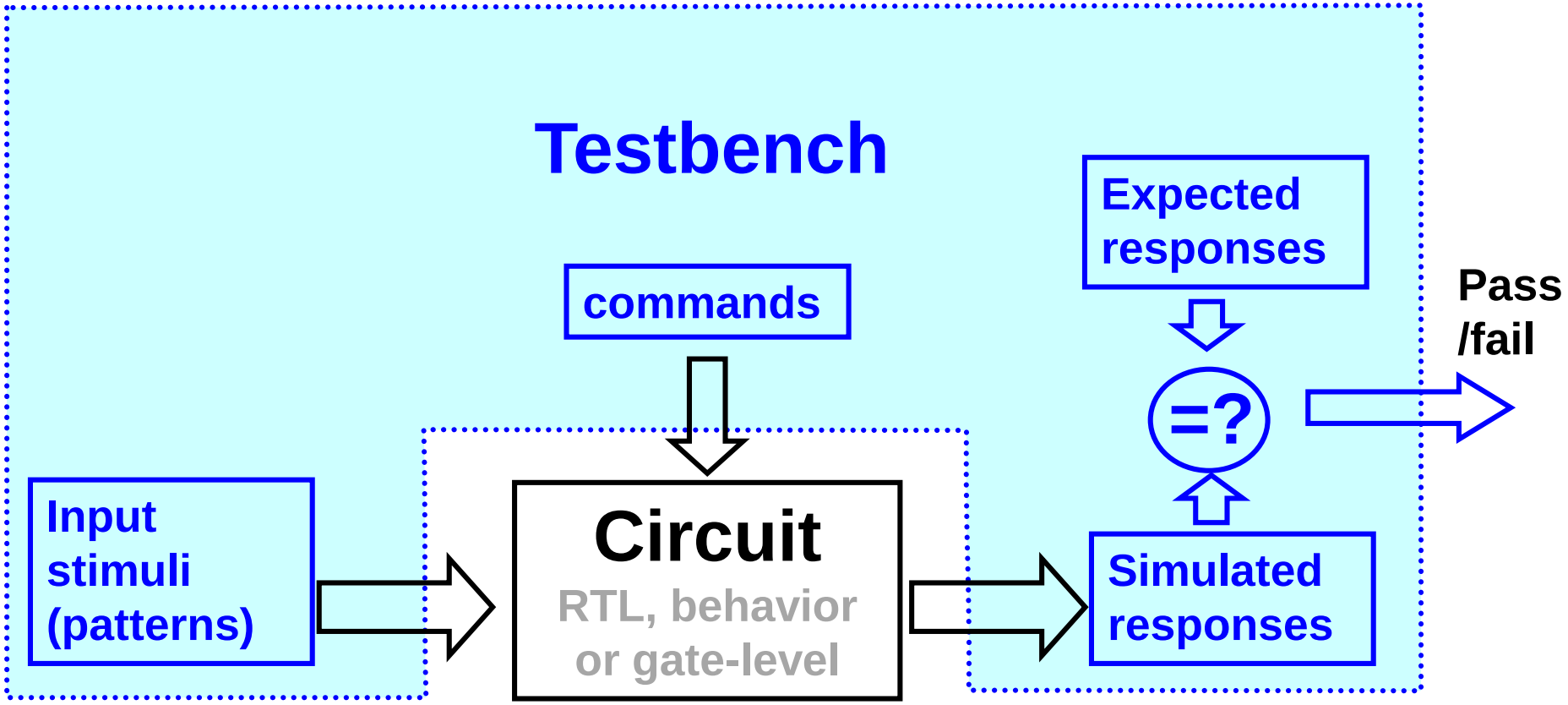


(Manual or Auto.)

(www Fig. 3.1)

What is Testbench ?

- Setup a simulation environment
- Apply input stimuli; run commands; observe responses



- Testbench is *NOT* implemented as physical circuits

Summary

- Introduction
  - What is simulation?
    - Produce output based on given input stimuli and model
  - Levels of simulation
    - functional, logic, transistor, mixed
  - Design verification by simulation
    - testbench