

Center for
Reliable
Computing



Automated FPGA Fault Diagnosis

Erik Chmelar

Electrical Engineering Ph.D. Candidate

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Shahin Toutounchi, Andrew Taylor

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FPGA Fault Diagnosis

- ❖ Field-programmable Gate Array (FPGA)
 - Configurable integrated circuit
- ❖ Fault diagnosis
 - Identify fault
 - Improve manufacturing process
- ❖ Current practice
 - *Ad hoc*
 - Manually-developed test configurations
 - Days to weeks per device
- ❖ Automated fault diagnosis
 - Use only existing test configurations
 - Hours per device

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Automated Fault Diagnosis Process

❖ Determine potential faults

- Test device
 - All or most test configurations
- Fault locate
 - Several failing configurations
 - Identify first bistable to capture faulty value
 - » Fault in fan-in cone

❖ Systematically eliminate potential faults

- Not common
 - All fault-located configurations
- Shown not to exist
 - Passing configurations

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Experimental Results

❖ 2 Xilinx Spartan-3 XC3S1000 devices

- 90 nm process technology

Device	1	2
Failing configs*	30%	25%
Fault-located configs	5	4
First-failing bistables	1	4
Potential logic faults	34	276
Common to all fault-located configs	34	0
Not eliminated by passing configs	9	0
Potential routing faults	-	83
Common to all fault-located configs	-	27
Not eliminated by passing configs	-	9
Fault	ws_en s@1	wire s@1

*Exact number of failing test configurations intentionally not provided.

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