MEMCON: Detecting and Mitigating Data-Dependent Failures by Exploiting Current Memory Content

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VISON: SYSTEM-LEVEL DETECTION AND MITIGATION

**CHALLENGE IN DETECTION**

Detection is hard due to intermittent failures.

DATA-DEPENDENT FAILURES

No failure

Failure

Some cells can fail depending on the data stored in neighboring cells.

How to detect data-dependent failures?

Test with specific data pattern in neighboring cells.

**MEMCON: MEMORY CONTENT-BASED DETECTION**

Current Detection Mechanism

Detect every possible failure with all content before execution.

MEMCON: MEMORY CONTENT-BASED DETECTION AND MITIGATION

No need to detect every possible failure.

High-level vision

1. No initial detection and mitigation
2. Start running the application with a high refresh rate
3. Detect failures with the current memory content
   - If no failure found, use a low refresh rate

MEMCON: COST-BENEFIT ANALYSIS

Cost: Extra memory accesses to read and write rows.

Benefit: If no failure found, can reduce refresh rate.

Initiate a test only when the cost can amortized.

What is the write interval that can amortize the cost?

MEMCON selectively initiates testing when the write interval is long enough to amortize the cost of testing.

MEMCON: REDUCTION IN REFRESH COUNT

On average 71% reduction in refresh count, very close to the upper bound of 75%.

MEMCON: PERFORMANCE IMPROVEMENT

Leads to significant performance improvement.