

Case Study: Verification of MIPS64 Microprocessor

Using MicroTESK Technology



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Overview

MicroTESK technology was applied to verification of a MIPS64-compatible microprocessor. The microprocessor implements 221 instructions. All instructions can be clustered into 13 groups:

- arithmetic (33 instructions)
- logic (8)
- move (8)
- shift (15)
- branch (20)
- nop (2)
- memory (26)
- interrupt (14)
- system (13)
- fpu.arithmetic (24)
- fpu.move (26)
- fpu.convert (26)
- fpu.branch (6)

Specification and Test Development

We used triples of instructions as test cases. Test situations and dependencies used for load/store instructions were focused on address spaces, TLB/cache hits/misses, etc. Test data for all kinds of arithmetic instructions were directed to exceptional cases and boundary values. Branch instructions were described by condition value (for conditional jumps) and jump direction (forward or backward).

The table below shows size of test descriptions in lines of code without comments (LOCWC).

Type of description	Volume, LOCWC	Volume, Percentage
Specification of subsystems	4450	10.5%
Specification of instructions	16650	39%
Test situations	20550	48%
Dependencies	1050	2.5%
Total	42700	100%

Detected Bugs

We have found 9 errors in the RTL model of the microprocessor and 6 errors in the microprocessor simulator (reference model).

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