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Robust Software Engineering

MODEL ANALYSIS AND VERIFICATION TESTING PAPER ACCEPTED

HIGHLIGHT: One of the objectives of the Model Analysis and Verification Testing Task is to develop automated testing capabilities for mission-critical software that both measure test coverage and generate test case suites satisfying user-specified test criteria. The enabling technologies for test case generation are software model checking, symbolic execution, and constraint solving. A paper describing this work was accepted for publication at the International Symposium on Software Testing and Analysis (ISSTA'08), Seattle, WA, July 20-24 2008. The paper, "Combining Unit-level Symbolic Execution and System-level Concrete Execution for Testing NASA Software," was co-authored by Corina Pasareanu, Peter Mehlitz, David Bushnell, Karen Gundy-Burlet, and Michael Lowry (ARC); Suzette Person (University of Nebraska-Lincoln); and Mark Pape (JSC).

ISSTA'08 is the leading research conference in software testing and analysis, bringing together academics, industrial researchers, and practitioners to exchange new ideas, problems, and experience.

BACKGROUND: The Model Analysis and Verification Testing project has developed an approach to testing complex safety-critical software that combines unit-level symbolic execution and system-level concrete execution to generate test cases that satisfy user-specified testing criteria. We have implemented a symbolic execution framework that performs a non-standard interpretation of bytecodes in the Java PathFinder model checking tool. The framework propagates the symbolic information via attributes associated with the program data. Novel techniques use system-level concrete program executions to gather information about a unit's input to improve the precision of the unit-level test case generation. We applied our approach to testing a prototype NASA flight software component (the CEV Onboard Abort Executive) developed at JSC. Our analysis helped discover a serious bug that resulted in design changes to the software.

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