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DISSERTATION TITLE: *Empirical Evaluations on the Cost-Effectiveness of State-Based Testing: Industrial Case Studies and Extensible Tool*

Model-based testing has become a popular area of research and practice for enabling automated testing to check the compliance of implementations against their specifications. Test models, for example expressed as UML state machines, describe the expected behavior of the software and provide the basis for systematic and automated generation of test suites. Despite the importance of being systematic while testing, all testing activities take place under resource constraints. Thus, reducing the cost of testing while ensuring sufficient fault-detection should be of common interest to industry.

This thesis evaluates the cost-effectiveness of state-based testing (SBT) by studying the influence of four testing aspects: coverage criterion, test oracle, test model and sneak paths.

Four industrial case studies, in the context of a research development project, were used to investigate the cost-effectiveness of SBT. To enable the evaluation of the SBT techniques, a model-based testing approach, TRUST, was configured and used to automatically generate the studied test suites. Furthermore, the generated test suites were evaluated using 26 real faults collected in a field study at three research departments in industry.

The majority of the studied coverage criteria (for conformance testing), when applied to a detailed test model and utilizing the state invariant oracle, yield test suites that kill the seeded faults (except from sneak paths). When also considering the costs, significant differences are observed. Large reductions in execution time are seen for the state pointer oracle when combined with the detailed test model. By making the test model less precise, results show that a comparable cost-effectiveness is obtained as compared to test suites generated from the detailed test model.

Each of the testing aspects coverage criterion, test oracle, and test model influence the cost-effectiveness and must be carefully considered when selecting strategy. Regardless of these choices, however, sneak-path testing is a necessary step in SBT as the presence of sneak paths is undetectable by conformance testing.