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Test Case/Step Minimization for Visual Programming Language Models and its Application to Space Systems

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Visual Programming Languages have been widely used in the context of Model-Based Development, and they find a particular appeal for the design of satellite subsystems, such as the Attitude and Orbit Control Subsystem (AOCS) which is an extremely complex part of a spacecraft. The software testing community has been trying to ensure high quality products with as few defects as possible. Given that exhaustive generation and execution of software test cases are unfeasible in practice, one of the initiatives is to reduce the sets of test cases required to test a Software/System Under Test, while still maintaining the efficiency (ability to find product defects, code coverage). This paper presents a new methodology to generate test cases for Visual Programming Language models, aiming at minimizing the set of test cases/steps but maintaining efficiency. The approach, called specification Patterns, modified Condition/Decision coverage, and formal Verification to support Testing (PCDVT), combines the Modified Decision/Condition Coverage (MC/DC) criterion, Model Checking, specification patterns, and a minimization approach by identifying irreplaceable tests in a single method, taking advantage of the benefits of all these efforts in a unified strategy. Results showed that two instances of PCDVT presented a lower cost (smaller number of test steps) and, basically, the same efficiency (model coverage) if compared with a specialist ad hoc approach. We used the AOCS model of a Brazilian satellite in order to make the comparison between the methods.

Model-Based Testing. Test Case/Step Minimization. Model Checking. Specification Patterns