Automated Test Case Generation from Highly Reliable System Requirements Models

Safeware Engineering Corporation

Technical Abstract
Software testing is a complex and expensive phase of the software development cycle. Effective software testing is especially important in mission-critical software, where erroneous behavior poses a risk to safety or mission success. Automated test case generation can make testing more efficient and effective, saving resources and reducing risk. Under Phase 1, Safeware Engineering Corporation successfully developed the algorithms necessary to streamline software testing by automatically generating test cases directly from SpecTRM-RL models. SpecTRM-RL (Specification Tools and Requirements Methodology Requirements Language) is a requirements language that was designed to be highly readable, allowing even non-specialists to understand them, but is also completely formal. Test cases generated from the black-box models written in SpecTRM-RL will focus on the intended behavior of the system. The test case generation tool will be designed to allow the user to choose between a smaller set of test cases, allowing for more rapid error identification, and a larger set providing more comprehensive coverage. The phase II effort will implement these algorithms, adding test-case generation to SpecTRM, the tool suite which allows for editing, analysis and execution of SpecTRM-RL models. The new test case generation tools will be tested on the Max Launch Abort System.

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Quantifiable and Reliable Structural Health Management Systems

Acellent Technologies, Inc.

Technical Abstract
Under Project Constellation, NASA is developing a new generation of spacecraft for human spaceflight. A significant percentage of the structures used in these spacecraft will be made of composite materials, and the Ares V payload shroud will be one of the largest composite structures ever built. This offers many challenges, not only for design and manufacturing, but also for inspection and maintenance. Inspection of large composite structures using traditional NDE methods is time consuming, expensive, and often not possible when access is limited (e.g. covered by a thermal protection system), resulting in a conservative (higher weight) design. Acellent proposes to develop a robust, state-of-the-art structural health monitoring (SHM) system to overcome these concerns. The Phase II will optimize the design and quantify the benefits for SHM on the Ares V payload shroud, and then expand the results to include other Ares V components such as the Altair Lunar Lander Structure, Earth Departure Stage (EDS) payload adapter, forward skirt and intertank, and the Core-to-EDS interstage. The proposed solution will be capable of detecting and quantifying damage with a high probability of detection (POD), accurately predicting the residual strength and remaining life of the structures with confidence, and providing information that will allow appropriate preventative actions on the monitored structure.

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