

Integrated Test Automation and Coverage for ISO 26262 using Mx-Suite™ with RapiCover

Developers of software for automotive applications in safety-related environments need to address the requirements of ISO 26262. One of the more challenging elements is the need to collect and report evidence of code coverage during testing, particularly MC/DC at ASIL-D.

This issue can be addressed using a combination of Mx-Suite™ for controlling tests and RapiCover for analyzing code coverage. An integration between these two tools means coverage can now be collected automatically during testing.

About Mx-Suite™

Mx-Suite™ is a software testing environment used within the automotive industry. It provides the ability to automate tests in a variety of environments including MIL (model in the loop), SIL (software in the loop) and PIL (processor in the loop). It offers support for AUTOSAR and helps with ISO 26262 compliance.

About RapiCover

RapiCover is a code coverage analysis tool designed specifically to work with embedded software. It works with SIL, PIL and HIL (hardware in the loop) environments.

| Type | Level | ASIL A | ASIL B | ASIL C | ASIL D |
|--------------------|---------------|--------|--------|--------|--------|
| Function coverage | architectural | R | R | HR | HR |
| Call coverage | architectural | R | R | HR | HR |
| Statement coverage | software unit | HR | HR | R | R |
| Branch coverage | software unit | R | HR | HR | HR |
| MC/DC | software unit | R | R | R | HR |

Table 1: ISO 26262 coverage metrics
(R = Recommended, HR = Highly Recommended)

MIL, SIL, PIL and HIL – what's the difference?

These are terms used to discuss testing embedded systems at different levels of abstraction.

MIL (model in the loop) refers to testing a model, such as MATLAB Simulink, in the modeling environment.

SIL (software in the loop) occurs where software is tested by compiling and executing on the development machine.

PIL (processor in the loop) compiles the software for an embedded target, which is closely controlled by the testing environment – usually this is a specific development board.

HIL (hardware in the loop) represents running the software on the hardware intended for deployment – in this case, the testing environment can rarely exert control over the execution of the system.

All of the coverage levels referenced by ISO 26262 are supported by RapiCover, including MC/DC (modified decision/condition coverage).

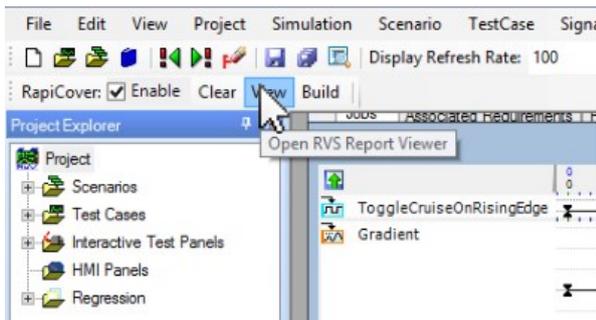
RapiCover's extremely low instrumentation overhead means that it is possible to collect code coverage in the most resource-constrained environments.



Integration

When using Mx-Suite™ with the RapiCover integration, coverage is automatically recorded as tests are executed. Once the tests are complete, the coverage report is opened from a toolbar within Mx-Suite™. The report provides a top level view of the amount of code that was covered.

When less than 100% coverage is achieved, the report can be quickly navigated to identify which parts of the code were not executed. Using this information, the tests can be reviewed to address these deficiencies in the code coverage.



RapiCover supports the measurement of coverage on a per-test case basis. The report can show the coverage achieved by a single test case, by combinations of test cases, or by all test cases.

About the integration

Mx-Suite™ now provides a RapiCover toolbar which allows developers and testers to enable/disable MC/DC structural coverage and aggregate coverage between test runs.

The offering allows users to rapidly create requirements-based test cases, execute them early in development, and determine structural coverage right down to the MC/DC level. Test cases can be easily rerun after the code is flashed onto an ECU. It improves the whole ISO 26262 qualification effort by shrinking test intervals, reducing costs, and automatically providing documented qualification evidence gathered during functional compliance testing and/or robustness/performance tests.

The current offering works out of the box with SIL. We can also work with you to make PIL or HIL solutions available.

Next steps

A video showing RapiCover working with Mx-Suite™ is available at www.rapitasystems.com/mxsuite

For further information about using RapiCover with Mx-Suite™, please contact Rapita Systems (see details below).

About Rapita Systems

Founded in 2004, Rapita Systems develops on-target embedded verification software solutions for customers in the automotive electronics and avionics industries. Our tools help to reduce the cost of measuring, optimizing and verifying the timing performance and test effectiveness of their critical real-time embedded systems.

About Danlaw

Danlaw's 300+ engineering professionals have been providing automotive embedded electronics solutions to OEMs and their tier-1 supply base for 30 years. Danlaw has facilities in the USA, India, and China. Danlaw's specialty areas include embedded systems development and testing for embedded control units (ECUs), vehicle network communications, infotainment, and telematics. Their customers include automotive OEMs, automotive electronics suppliers, fleet and automotive insurance companies worldwide.



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