

DO-254: Preconceived ideas about FPGA on-board verification

Idea

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This series of articles "Preconceived ideas about..." aims at sharing our feedback about specific issues we faced at Oxytronic during various FPGA developments following the DO-254 guidelines. And especially how we solved them and achieved the highest level of verification quality.

DO-254 - "FPGA on-board verification KPIs are difficult to establish." Really?

Leading edge simulations tools provide a lot of features which help demonstrate the verification is exhaustive, by giving lots of KPIs such as functional code coverage, assertions coverage or even traceability links to the specification. Such KPIs are well appreciated by the certification authorities for DO-254 development because they give an accurate and objective measurement of the verification performed on the device under test.

Everyone thinks it is difficult to achieve the same goal when the FPGA is verified on its final application board?... Actually it is not!

Traditional method to get on-board verification requirements coverage rate.

As required by RTCA, DO-254 physical verification test procedures must cover - through a traceability link - the FPGA requirements they address. This point is furthermore confirmed by the test procedures review activity performed by independent peers and which assess that procedures are well covering the FPGA requirements.

So we get all the information to provide a first KPI: FPGA requirements coverage rate by the physical verification test procedures.

Traditional method to get requirements implementation defect rate.

In the same way, once the verification results are available, it is possible to establish a KPI which indicates the defect rate in the implemented requirements. Each test procedure which results in a failure will lead to report a requirement defect.

We already experiment the elaboration of such KPI, but it can be more difficult to get that it seems. When a test procedure reports a failure, a complementary analysis can be necessary to clearly identify the involved requirement. To ease this work it can be useful to define small test steps, each linked only to one requirement. Then once a failure occurs it is possible to identify immediately the involved requirement.

So it is possible to present a KPI reporting the rate of requirements defect during on-board verification.

Advanced KPIs to ensure on board verification completeness.

Even if the elaboration of traditional KPIs is necessary, it is also possible to take advantage of the KPIs given by the simulation tools, such as functional code coverage – required by RTCA DO-254 and FAA order 208110.105 – or assertions coverage during the FPGA on-board verification.

To do this, a strict equivalence between the physical and the virtual testbenches must be ensured. Once this has been clearly demonstrated, it allows playing the same hardware test procedures either on the board or inside a simulator. As a result the virtual simulation metrics are de facto applicable to on-board verification.

This gives advanced KPIs to demonstrate the completeness of the verification conducted on the board.

Which KPI will you provide for your FPGA on-board verification?

There are several ways to provide efficient KPIs for the FPGA on-board verification activities to the certification authorities. Even if traditional approach such as requirements coverage rate by hardware test procedures and requirements implementation defect rate are a must have, you can also use more advanced metrics, provided by simulation tools and applied to the physical verification. So by using the right tools and the right methodology it is possible to show factual and incontestable metrics associated to the FPGA on-board verification.

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For more information about AVP254, our DO-254 FPGA verification platform: [Here](#)