

Master 2 Internship Increasing controllability in an offline testing approach

Using formal methods to generate test cases has been widely studied in the frame of Model Based Testing. In the domain of reactive systems, models are often given as labelled transition systems which describe the expected sequences of input and output data (called traces). Real executions of the System Under Test (SUT) can also be seen as traces. Testing an SUT comes to interact with it to build traces which are analyzed regarding to its model to provide verdicts. In black box testing, an SUT is often hardly controllable at the test execution phase, typically because, for the sake of abstraction, its reference model may include non-deterministic situations (i.e. after a given trace, several outputs may occur). For this reason, when dealing with automatic test case generation, approaches in which inputs to be sent to the SUT are computed on-the-fly are very popular: they permit to stimulate it in a flexible manner depending on observed SUT executions, and depending on the goal of the testing process in terms of behaviours to cover. Such approaches are often qualified as online testing.

The other alternative consists in computing the full input sequence; submitting the sequence to the SUT; storing the output sequence of the SUT during the execution phase; computing a posteriori a verdict by analyzing the trace resulting from the merge of input and output sequences. Such approaches, qualified as offline testing ones, have several advantages. First, computed input sequences can be stored and later translated into several formats, in particular to become compatible with various home made test benches in different industrial contexts. This allows one to avoid the intertwining (unavoidable in on-line approaches) of the test generation/test execution/verdict computation processes, which may be technically hard to achieve. Second, tests can be replayed as many times as desired which makes offline methods particularly well-adapted for non-regression testing. Third, by construction, no constraint solving delays can interfere with the test data execution. To sum up, offline testing eases the deployment of input sequences in the test environment and enables their reuse.

At CEA LISE laboratory, we have developed an offline model based testing algorithm for real time systems ([BGLE12]) based on the conformance relation tioco ([KT04]). This has been done by extending previous works on model based testing ([GAS06]) based on symbolic execution techniques, initially in an untimed framework. The objective of the internship is to improve existing selection techniques of input sequence, in order to increase controllability at the test execution phase. Results of the internship will be implemented in the Diversity testing tool of CEA LISE.

[KT04] M. Krichen and S. Tripakis. Black-box time systems. In Proceedings of the International SPIN Workshop Model Checking of Software. Springer, 2004.

[GAS06] Christophe Gaston, Pascale Le Gall, Nicolas Rapin, Assia Touil, "Symbolic execution techniques for test purpose definition", Testing of Software and Communicating Systems: 18th IFIP TC 6/WG 6.1 International Conference, TestCom 2006. Lecture Notes in Computer Science.

[BGLE12] Boutheina Bannour, Christophe Gaston, Pascale Le Gall and José Pablo Escobedo, Off-line test case generation for timed symbolic model-based conformance testing, 24th IFIP Int. Conference on Testing Software and Systems: ICTSS'12, November 19-21 2012. Springer.