Review of Ing. Jan Fiedor's PhD thesis

The thesis focuses on concurrent programs and their testing, validation, and debugging – a hard and state-of-the-art challenge that includes validating an exponential space of possible interleavings, the need to reason on temporal sequences of events, and the fact that measuring the behavior of the system changes its behavior.

In his thesis, Jan Fiedor devotes a lot of space to testing supported by the so-called noise injection. Jan proposes several novel heuristics that are experimentally shown to significantly boost the efficiency of noise in many cases. To be able to experiment with the newly developed techniques, Jan has built a new framework – called ANaConDA – for dynamic analysis and noise based testing. This tool has reached a fairly high level of maturity for an academic tool.

Jan has also proposed a unique combination of testing based on noise injection and extrapolating dynamic analysis with bounded model checking. The combined approach is shown to be able to combine the advantages from both testing (scalability) and model checking (precision).

Moreover, Jan has also worked on monitoring of programs using transactional memories. He analysed the impact of monitoring on such programs and proposed several ways of monitoring which differ in the amount of information collected, flexibility, and, on the other hand, amount of influence on the monitored programs.

Another key result of Jan is a unique dynamic analysis for checking the correctness of so-called contracts for concurrency. This approach is primarily designed to look for bugs in improper atomicity of using libraries or modules in a concurrent setting. However, it is fairly flexible and can be used, e.g., to check bugs such as order violation for which not many approaches have been proposed so far.

Finally, a taxonomy of synchronization defects that can help in driving the research in noise generation and comparing the different techniques being developed.

Overall, a quite significant progress is made on the test and validation of concurrent systems in the thesis of Jan Fiedor.

The work is well published through an STVR 2014 journal publication augmented by a long list of publications at various conferences and workshops. The latter includes publications at top venues such as ICST 2017, RV 2011, RV 2012, or PADTAD 2012.

To sum up, in my opinion, the doctoral thesis of Jan Fiedor meets the requirements of the proceedings leading to PhD title conferment.

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