UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA
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SEMINAR ANNOUNCEMENT

Thursday March 21st, 2024

at 03:00 pm

Room "Sala Seminari" - Abacus Building (U14)

Fault diagnostics for safety-critical cyber–physical systems

Speaker
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Abstract
Cyber-Physical systems (CPS) continue to bestow fascinating challenges as their complexity evolves. To cope with this complexity, researchers and practitioners have embraced model-based development centred around the MathWorks MATLAB/Simulink® environment. However, analyzing failures in CPS Simulink models demands a multitude of faults, a scarcity often encountered in practical settings. To address this scarcity, we introduced a fault injection solution for Simulink, facilitating large-scale mutation testing evaluations by automating the injection of various fault types into system models. In general, failures observed in Simulink models pose unique debugging and explanatory challenges due to the intricate nature of computations involving most model elements. Strategies based solely on detecting activated elements in failed tests are ineffective in this context. To overcome this, we focused on generating and comparing close passing and failing executions to isolate the internal behaviors likely responsible for the failures.

Mutation testing, a software quality assurance strategy, is invaluable in conducting extensive experiments with synthetic faults to test the model thoroughly. However, the conventional notion of mutant killing is not particularly useful in CPS Simulink models, where faults are easily activated and propagated to the output, rendering them trivial to kill. Consequently, a mutant-killing test may not effectively reveal faults, especially when validating models against specific properties. To address this challenge, we introduced property-based mutation testing, which generates tests that not only exercise faults but also magnify their impact on the model to the extent of violating available properties. This talk will delve into recent advancements in failure analysis of CPS Simulink models. Additionally, I will discuss our ongoing work on defining a new notion of coverage for CPS Simulink models that explicitly consider the features of internal signals, and investigating the fault-revealing capability of the test suites based on this coverage criterion.

Short Bio
Drishti Yadav earned her B.E. degree in Electrical and Electronics Engineering from Shri Shankaracharya Technical Campus, Bhilai, Chhattisgarh, India, in 2017, followed by an M.Tech degree in Control and Instrumentation Engineering from Dr. B. R. Ambedkar National Institute of Technology Jalandhar, India, in 2020. Currently, she is pursuing her doctoral studies in Computer Science at TU Wien, Vienna, Austria, where she serves as a University Assistant at the Cyber-Physical Systems research group within TU Wien's Faculty of Informatics. Her research primarily revolves around fault-based testing and verification of safety-critical cyber-physical systems.

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