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DISSERTATION TITLE: *Uncertainty-wise Cyber-Physical Systems Testing*

Man Zhang is a PhD student at Simula Research Laboratory, Norway (2015 - present) and the Department of Informatics, University of Oslo, Norway. Previously, she obtained her Master degree in Computer Technology from Beihang University, Beijing, China (2012 - 2015). Her Ph.D. research was funded by an EU Horizon 2020 project, U-Test, for developing a systematic, extensible and configurable model-based and search-based methodologies for testing Cyber-Physical Systems (CPSs) under uncertainty. Her research interests include software verification and validation, model-based testing, search-based testing, and requirement engineering.

A Cyber-Physical Systems (CPS), as an integration of computing, communication, and control for making intelligent and autonomous systems, has been widely applied in various safety-critical domains, e.g., avionics and automotive. However, uncertainty is inherent in CPSs due to various reasons such as unpredictable environment under which the CPSs are operated. And, uncertainties may cause irreparable accidents once they cannot be handled properly by CPSs. Therefore, it is crucial to identify uncertainties in CPSs and test CPSs under the uncertainties, to ensure that CPSs are capable of handling the uncertainties during their actual operations, i.e., making CPSs less uncertain.

Uncertainty-wise Cyber-Physical Systems Testing enabled a comprehensive identification of uncertainty in CPSs and offered a systematic and cost-effective manner to test CPSs under uncertainty. More specifically, the *Uncertainty-wise Cyber-Physical Systems Testing* includes five works: (1) a conceptual model, named as U-Model, for helping develop a systematic and comprehensive understanding of uncertainty in CPSs; (2) an use case modeling methodology, named as U-RUCM, for identifying, qualifying, and, where possible, quantifying uncertainty in requirements engineering; (3) a test modeling methodology, named as UncerTum, for constructing test ready models (i.e., the models can be used to express the expected behavior of the system under test, and/or its environment to be tested) with uncertainties in CPSs; (4) an evolution framework, named as UncerTolve, for interactively evolving test ready models against real operational data collected from real applications of CPSs; and (5) a testing framework, named as UncerTest, for testing CPSs in the presence of uncertainties.