

CS 515: Model-Based Testing vs. Model Checking

Stefan D. Bruda

Winter 2019



- Both algebraic methods (e.g., model-based testing) and logical methods (model checking) accomplish the same thing (verify a system against a specification)
- However, they use different models for both specification and system under test
 - The specification formalisms are dramatically different, but at least they accomplish the same thing (specify properties)
 - The system models are more similar in structure, but they specify dramatically different things
 - Evolving program states in Kripke structures vs. a behavioural model of actions that cause change of states in transition systems
 - They must however be equivalent on a more philosophical level: those reactive systems (transition systems) are computing systems and so ultimately implemented as a program (Kripke structure)
 - It is therefore expected that the two methods are equivalent (since they ultimately verify the same thing)
- Example of equivalence already established: CTL and stable failures/failure trace testing

<https://arxiv.org/abs/1901.10925>



Several steps necessary to establish equivalence between stable failures (failure trace tests actually) and CTL:

- 1 Need to define a way of converting transition systems into Kripke structures (or the other way around)
 - In turn this requires the definition of CTL semantics over transition systems (natural concept of outgoing actions as true propositions for each state)
 - At least two such conversions can be defined
 - They both require some minor variations of the CTL semantics
- 2 Need to construct equivalent failure trace tests for CTL formulae
 - Algorithmic construction by induction over number of operators in the formula
- 3 Need to construct equivalent CTL formulae for failure trace tests
 - Algorithmic construction by induction over the depth of the test
 - Naive conversion may result in infinite formulae, needs special handling of recursive tests (less elegant but still relatively straightforward)