Topics on verification and validation techniques

Basic topics

McNaughton theorem and Safra algorithm

Decidability of the emptiness problem for Rabin tree automata

Closure of Rabin tree automata under complementation

LTL satisfiability checking: a one-pass and tree-shaped tableau-based decision procedure for LTL

CTL satisfiability checking

CTL* satisfiability checking

Tableau-systems for temporal logics

CTL* model checking

Automaton-based model checking

Partial order reduction

The synthesis problem for temporal logics

The synthesis problem for timed automata

Advanced topics

First-order definable languages

From regular / omega-regular expression to automata via partial derivatives

Complementation and determinization of Buechi word automata based on profile trees

Unambiguous automata

From two-way automata to one-way automata

Unambiguous transducers

Reversible transducers

First-order logic of one successor and its relationships with first-order logic of the ordering relation

Canonical/normal forms for temporal logics and separation theorems

Classification of temporal properties (safety, liveness, and beyond)

Safety LTL

Signal Temporal Logic (STL): expressiveness, satisfiability checking, model checking, and synthesis

Interval temporal logics: expressiveness, satisfiability checking, model checking, and synthesis

A unified translation of LT into omega automata (deterministic Rabin automata, nondeterministic
Buechi automata, limit-deterministic Buechi automata)

Satisfiability modulo theory (STM) solvers

LTL verification via K-liveness

the SAT-based model checking algorithm IC-3

Model checking infinite state systems

Reachability analysis of pushdown systems

Well-structured transition systems

Algorithms for parity games