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Constructing invariants for hybrid systems. (English) Zbl 1133.68365

Summary: We present a new method for generating algebraic invariants of hybrid systems. The method reduces the invariant generation problem to a constraint solving problem using techniques from the theory of ideals over polynomial rings. Starting with a template invariant – a polynomial equality over the system variables with unknown coefficients – constraints are generated on the coefficients guaranteeing that the solutions are inductive invariants. To control the complexity of the constraint solving, several stronger conditions that imply inductiveness are proposed, thus allowing a trade-off between the complexity of the invariant generation process and the strength of the resulting invariants.

MSC:
68Q45 Formal languages and automata
13P10 Gröbner bases; other bases for ideals and modules (e.g., Janet and border bases)
68W30 Symbolic computation and algebraic computation

Keywords:
Hybrid systems; Analysis; Verification; Invariants; Polynomials; Algebraic geometry; Gröbner bases

Software:
HyTech; Kronos; QEPCAD; d/dt; Uppaal

Full Text: DOI

References: