Summary: Hybrid systems – more precisely, their mathematical models – can exhibit behaviors, like Zeno behaviors, that are absent in purely discrete or purely continuous systems. First, we observe that, in this context, the usual definition of reachability – namely, the reflexive and transitive closure of a transition relation – can be unsafe, i.e., it may compute a proper subset of the set of states reachable in finite time from a set of initial states. Therefore, we propose safe reachability, which always computes a superset of the set of reachable states.

Second, in safety analysis of hybrid and continuous systems, it is important to ensure that a reachability analysis is also robust w.r.t. small perturbations to the set of initial states and to the system itself, since discrepancies between a system and its mathematical models are unavoidable. We show that, under certain conditions, the best Scott continuous approximation of an analysis A is also its best robust approximation.

Finally, we exemplify the gap between the set of reachable states and the supersets computed by safe reachability and its best robust approximation.

MSC:

68Q85 Models and methods for concurrent and distributed computing (process algebras, bisimulation, transition nets, etc.)
06B35 Continuous lattices and posets, applications
18B20 Categories of machines, automata
93B25 Algebraic methods

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dReach

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References:
[11] Damn, W.; Pinto, G.; Ratschan, S., Guaranteed termination in the verification of LTL properties of non-linear robust discrete


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