First results on nonlinear hybrid reachability combining interval Taylor method and IBEX library.*

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Computing the reachable set of hybrid dynamical systems in a reliable and verified way is an important step when addressing verification or synthesis tasks. This issue is still challenging for uncertain nonlinear hybrid dynamical systems.

In a previous work [1], we introduced a method for solving the flow/sets intersection issue that is at the core of hybrid reachability. It derives first an analytical expression for the boundaries of continuous flows using interval Taylor methods and techniques for controlling the wrapping effect. Then, it expresses the event detection and localization problems underlying flow/sets intersection as constraint-satisfaction problems (CSP), which were then solved using global search methods based on some ad-hoc branch-and-prune algorithms, interval analysis and consistency techniques.

In this talk, we report the technical improvements of the above method as obtained by using the IBEX[1] library [2] for solving the underlying CSPs. The performance of the new method is illustrated on several hybrid systems benchmarks.

References

[1] N. Ramdani and N. S. Nedialkov. Computing reachable sets for uncertain nonlinear hybrid systems using interval constraint-propagation techniques. *Nonlinear Analysis: Hybrid Systems*, 5(2):149 – 162, 2011.

[2] G. Chabert and L. Jaulin. Contractor programming. *Artificial Intelligence*, 173:1079 – 1100, 2009.

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[1]`www.emn.fr/z-info/ibex/`