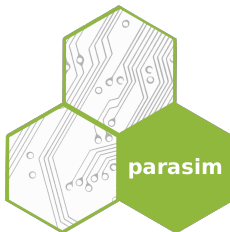# Tool for Parallel Simulations and Verification

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Parasim

- tool for parallel simulations and verification
- Java-based, open source, freeware
- contributors: Sven, Papi, Tomáš
- available on
  https://github.com/sybila/parasim/wiki

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Milestones

Start of 2012 Program for Support of Students' Projects

Summer 2012 Working CLI application

Autumn 2012 GUI application, user documentation

Spring 2013 Acceleration, extensions

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Outline

1. continuous deterministic systems verification
2. how Parasim does this
3. Parasim structure
4. analysis demonstration

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Goal

$$\mathcal{M} \models^? \varphi$$

- automatic deciding procedure
- feasible for *discrete* systems
- difficult for *continuous* systems

Setting

model : system of ordinary differential equations

parameters : initial conditions, coefficients

- simulation $\implies$ trajectories

property : temporal logic formula

- monitoring: $s \overset{?}{\models} \varphi$

Perturbation Set

- hyperrectangle in parameter space

  $P : p_1 \in [a_1, b_1], p_2 \in [a_2, b_2], \ldots, p_n \in [a_n, b_n]$

- satisfaction set – set of parameter values which generate trajectories satisfying φ 🔍**1**

- property satisfaction w.r.t. perturbation set

  $$P \overset{?}{\models} \phi$$

  $\forall$, proportion, sets

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Satisfaction w.r.t Perturbation Set

- continous set $\implies$ infinitely many points
- approximation – efficient, reasonably precise
- $\implies$ sampling (representants) ✎2
  - random
  - dense
- dimensionality curse – n^d samples
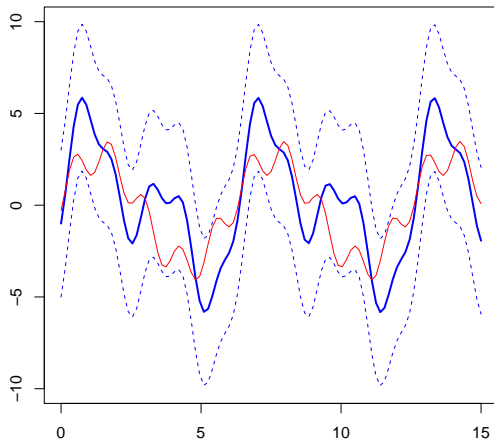- $\implies$ intelligent exploration

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Robustness

$$\rho(\varphi, s)$$

- robust signal neighbourhood – tube
- how much s can deviate while satisfying ϕ

$$d(s, s') \leq |\rho(\varphi, s)| \implies (s \models \varphi \iff s' \models \varphi)$$

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Robust Neighbourhood

Parasim Heuristics

- signal neighbourhood $\approx$ parameter space neighbourhood
- movement in parameter space does not change signals too much ✎3
- samples are chosen according to robustness

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