hybr2d Theory of Hybrid Systems Informatik 2

RWTH AACHEN UNIVERSITY

Satisfiability Checking - WS 2016/2017

Series 11

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Exercise 1: Interval arithmetic

Apply basic interval arithmetic as presented in the lecture.

$$x \in I_x = [-1; 3], y \in I_y = [2; 6]$$

Calculate:

1. $2 \cdot x + y$
2. $x^2 - 4 \cdot x + 7$
3. $x \cdot x \cdot y$
4. $\frac{2 \cdot x}{y}$
5. $z \in (3; 4]$, calculate: $x + z - y$

Exercise 2: Propagation

a) Given the following constraints

$$c_1 : 2 \cdot x - 3 \cdot y = 0, c_2 : x^2 - 2 \cdot y = 0,$$

perform two interval propagation steps. In each step choose the most appropriate contraction candidate. The initial intervals of x and y are $x, y \in [1; 10]$.

b) Given the constraints

$$a^2 + b^2 < 1 \text{ and } a \cdot b > 1$$

preprocessing yields the following equations and initial bounds:

$$\begin{array}{lll} e_1 : & h_1 = a \cdot b & h_1 \in (1, \infty) \\ e_2 : & h_2 = a^2 & h_2 \in (-\infty, \infty) \\ e_3 : & h_3 = b^2 & h_3 \in (-\infty, \infty) \\ e_4 : & h_4 = h_2 + h_3 & h_4 \in (-\infty, 1) \\ & & a \in (\infty, \infty) \\ & & b \in (\infty, \infty) \end{array}$$

Propagate using these equations until unsatisfiability is proven for at least one of the variables.

Exercise 3: Questions

Give a short answer to the following questions:

1. The ICP algorithm from the lecture maintains two threshold values as parameters. Describe the purpose of these values.

2. Which are the two events causing a split in the ICP algorithm presented in the lecture?
3. ICP is not a complete method. Why does it still make sense to use it as a preprocessing to a complete method, such as CAD or VS?