

Inner addition and subtraction
vs.
Multidimensional RDM Interval Arithmetic
(A discussion related to IEEE Standard 1788-2015)

Inner addition and subtraction

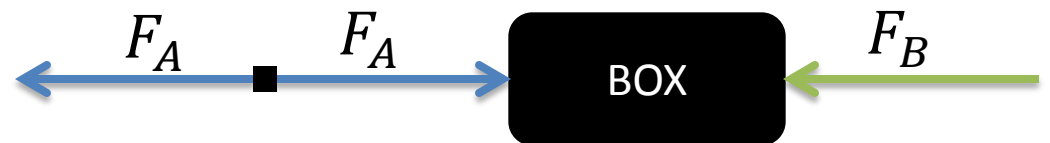
Let F_A and F_B correspond to two different robotic arms force

F_A is about 2 and F_B is about 2. $F_A, F_B \in \overline{\mathbb{R}}$

$$F_A = [1 \ 3], F_B = [1 \ 3]$$



$$F_B -^- F_A = 0$$



$$(F_B -^- F_A) +^- F_A = F_A$$

$$F_B +^- (0 -^- F_A +^- F_A) = F_B$$

Restoration issue

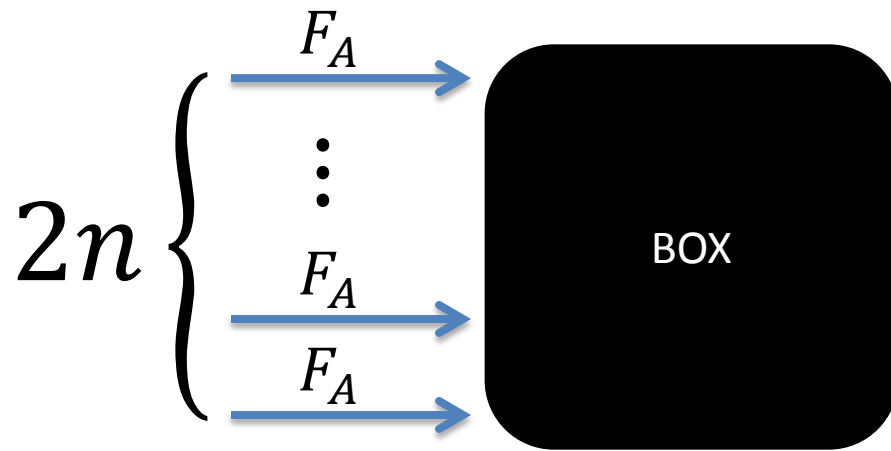
Second solution

Inner addition and subtraction

Assume we have $2n$ robots ($n \in \mathbb{R}$) which are of the same (or different) type. For the sake of simplicity let them be the same type A . F_A corresponds to a robotic arm force.

F_A is about zero. $F_A \in \overline{\mathbb{IR}}$

$$F_A = [-1 \ 1]$$



The box
does not
move !!

$$F_A +^- F_A +^- \dots +^- F_A = 0$$

Self-Reduction issue

Multidimensional RDM Interval Arithmetic

Let F_A and F_B correspond to two different robotic arms force

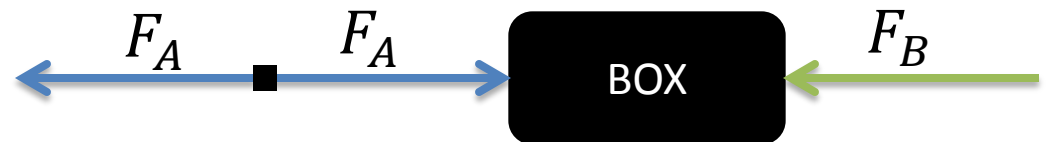
F_A is about 2 and F_B is about 2. $F_A, F_B \in \overline{\mathbb{R}}$

$$F_A = [1 \ 3], F_B = [1 \ 3]$$

$$F_B = 2\alpha_b + 1, F_A = 2\alpha_a + 1$$

$$\alpha_a, \alpha_b \in [0,1]$$

$$F_B - F_A = 2(\alpha_b - \alpha_a)$$



$$(F_B - F_A) + F_A = F_B + (-F_A + F_A) = 2\alpha_b + 1$$

Unique solution, and there is no Restoration issue

Multidimensional RDM Interval Arithmetic

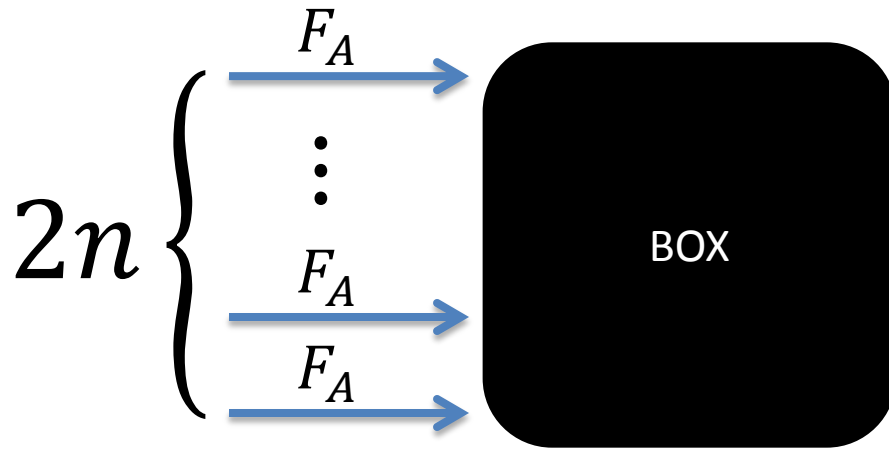
Assume we have $2n$ robots ($n \in \mathbb{R}$) which are of the same (or different) type. For the sake of simplicity let them be the same type A . F_A corresponds to a robotic arm force.

F_A is about zero. $F_A \in \overline{\mathbb{IR}}$

$$F_A = [-1 \ 1]$$

$$F_A = 2\alpha_a$$

$$\alpha_a \in [0,1]$$



Now, the box may move.

$$F_A + F_A + \cdots + F_A = 2n\alpha_a$$

There is no self-reduction issue.