5.313 orth_on_top_of_orth

DESCRIPTION LINKS GRAPH

Origin Used for defining place_in_pyramid.

Constraint orth_on_top_of_orth(ORTHOTOPE1, ORTHOTOPE2, VERTICAL_DIM)

Type
ORTHOTOPE : collection(ori−dvar, siz−dvar, end−dvar)

Arguments
ORTHOTOPE1 : ORTHOTOPE
ORTHOTOPE2 : ORTHOTOPE
VERTICAL_DIM : int

Restrictions
$|\texttt{ORTHOTOPE}| > 0$
require_at_least$(2, \texttt{ORTHOTOPE}, [\texttt{ori}, \texttt{siz}, \texttt{end}])$
$\texttt{ORTHOTOPE.siz} \geq 0$
$\texttt{ORTHOTOPE.ori} \leq \texttt{ORTHOTOPE.end}$
$|\texttt{ORTHOTOPE1}| = |\texttt{ORTHOTOPE2}|$
$\texttt{VERTICAL\_DIM} \geq 1$
$\texttt{VERTICAL\_DIM} \leq |\texttt{ORTHOTOPE1}|$
orth_link_ori_siz_end(ORTHOTOPE1)
orth_link_ori_siz_end(ORTHOTOPE2)

Purpose
ORTHOTOPE1 is located on top of ORTHOTOPE2 which concretely means:
- In each dimension different from VERTICAL_DIM the projection of ORTHOTOPE1 is included in the projection of ORTHOTOPE2.
- In the dimension VERTICAL_DIM the origin of ORTHOTOPE1 coincide with the end of ORTHOTOPE2.

Example
$$\left(\begin{array}{l} \langle \texttt{ori} - 5\ \texttt{siz} - 2\ \texttt{end} - 7, \texttt{ori} - 3\ \texttt{siz} - 3\ \texttt{end} - 6 \rangle, \\ \langle \texttt{ori} - 3\ \texttt{siz} - 5\ \texttt{end} - 8, \texttt{ori} - 1\ \texttt{siz} - 2\ \texttt{end} - 3 \rangle, 2 \end{array} \right)$$

As illustrated by Figure 5.652 the orthotope ORTHOTOPE1 (rectangle R1 coloured in pink) is on top of ORTHOTOPE2 (rectangle R2 coloured in blue) according to the hypothesis that the vertical dimension corresponds to dimension 2 (i.e., $\texttt{VERTICAL\_DIM} = 2$). This stands from the fact that the following conditions hold:

- $\texttt{ORTHOTOPE2}[2].\texttt{ori} + \texttt{ORTHOTOPE2}[2].\texttt{siz} = 1 + 2 = \texttt{ORTHOTOPE1}[2].\texttt{ori}$,
- $\texttt{ORTHOTOPE2}[1].\texttt{ori} = 3 \leq \texttt{ORTHOTOPE1}[1].\texttt{ori} = 5$,
- $\texttt{ORTHOTOPE1}[1].\texttt{end} = 7 \leq \texttt{ORTHOTOPE2}[1].\texttt{end} = 8$.

Consequently, the orth_on_top_of_orth constraint holds.

Typical
$|\texttt{ORTHOTOPE}| > 1$
$\texttt{ORTHOTOPE.siz} > 0$

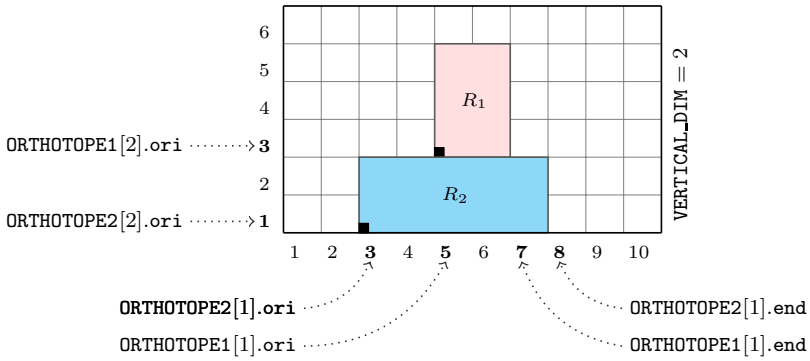

Figure 5.652: Illustration of the relation *on top of* of the **Example** slot (R_1 on top of R_2 wrt dimension VERTICAL_DIM $= 2$)

Used in place_in_pyramid.

Keywords **constraint type:** logic.

geometry: geometrical constraint, non-overlapping, orthotope.

Arc input(s)	ORTHOTOPE1 ORTHOTOPE2
Arc generator	$PRODUCT(=) \mapsto$collection(orthotope1, orthotope2)
Arc arity	2
Arc constraint(s)	• orthotope1.key $\neq$ VERTICAL_DIM • orthotope2.ori $\leq$ orthotope1.ori • orthotope1.end $\leq$ orthotope2.end
Graph property(ies)	**NARC**$= \lvert$ORTHOTOPE1$\rvert - 1$

Arc input(s)	ORTHOTOPE1 ORTHOTOPE2
Arc generator	$PRODUCT(=) \mapsto$collection(orthotope1, orthotope2)
Arc arity	2
Arc constraint(s)	• orthotope1.key $=$ VERTICAL_DIM • orthotope1.ori $=$ orthotope2.end
Graph property(ies)	**NARC**$= 1$

Graph model The first and second graph constraints respectively express the first and second conditions stated in the **Purpose** slot defining the orth_on_top_of_orth constraint.

Parts (A) and (B) of Figure 5.653 respectively show the initial and final graph associated with the second graph constraint of the **Example** slot. Since we use the **NARC** graph property, the unique arc of the final graph is stressed in bold.

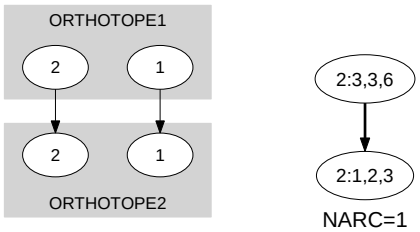

Figure 5.653: Initial and final graph of the orth_on_top_of_orth constraint

Signature Consider the second graph constraint. Since all the key attributes of the ORTHOTOPE1 collection are distinct, because of the arc constraint orthotope1.key $=$ VERTICAL_DIM, and since we use the $PRODUCT(=)$ arc generator the final graph contains at most one arc. Therefore we can rewrite the graph property **NARC** $= 1$ to **NARC** ≥ 1 and simplify $\overline{\mathbf{NARC}}$ to $\overline{\mathbf{NARC}}$.