Polyhedral geometry 4

Computational Visual Design Laboratory
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Examples

Examples

Use of MKPOL constructor

MKPOL: stands for MaKe POLyhedron

the definition of a single convex cell (with 5 vertices)

```
verts = [[0,0],[4,0],[4,4],[2,6],[0,4]]
cells = [[1,2,3,4,5]]
pols = None
muro = MKPOL([verts, cells, pols])
VIEW(muro)
VIEW(SKELETON(1)(muro))
```

Use of MKPOL constructor

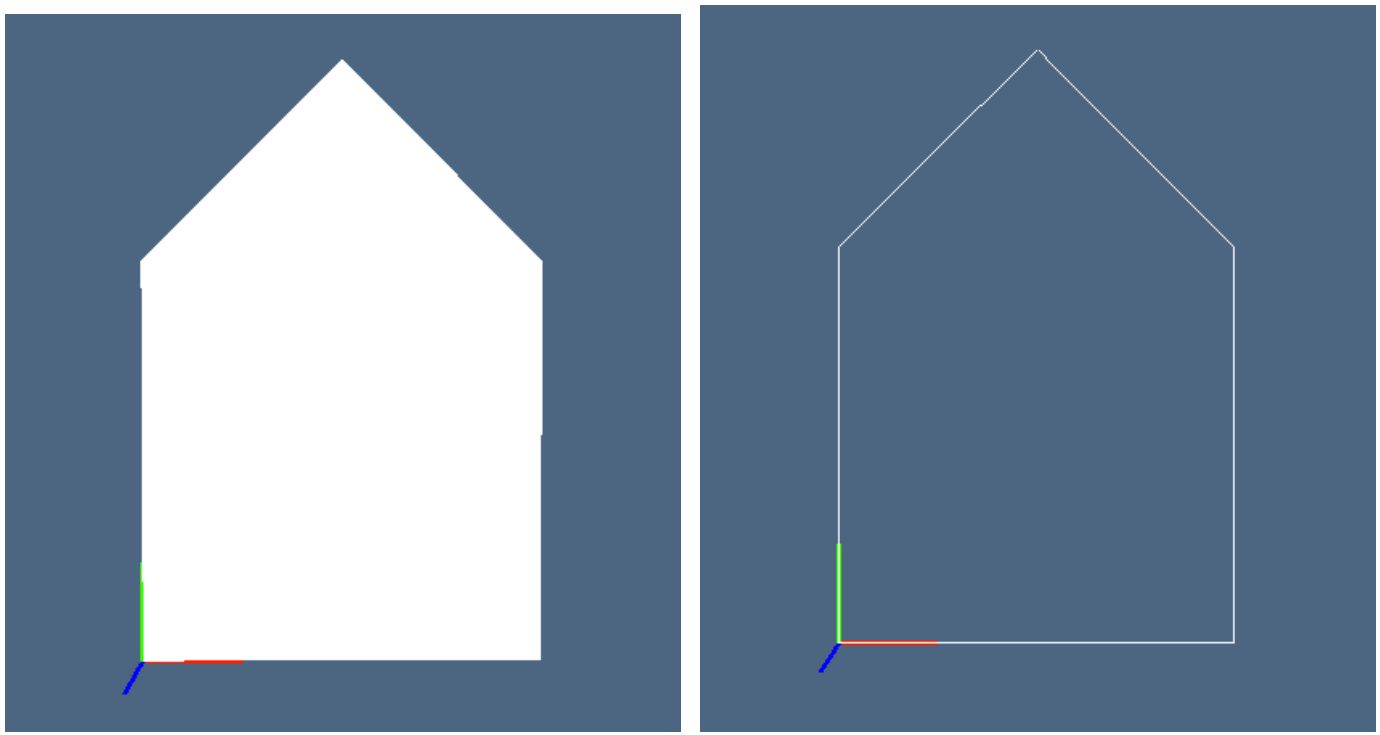

Figure : (a) `hpc` complex value constituted by a single convex cell; (b) its 1D skeleton

Use of primitive (translation) tensor

Translation: T(coords)(parameters)(object)

two primitive objects

```
door = CUBOID([1,3])
window = CUBOID([1,1.5])
```

one assembly

```
VIEW(STRUCT([muro, door, window]))
VIEW(SKELETON(1)(STRUCT([muro, door, window])))
VIEW(SKELETON(1)(STRUCT([muro, T(1)(1.5)(door),
    T([1,2])([2.75,1.5])(window)])))
```

Use of primitive (translation) tensor

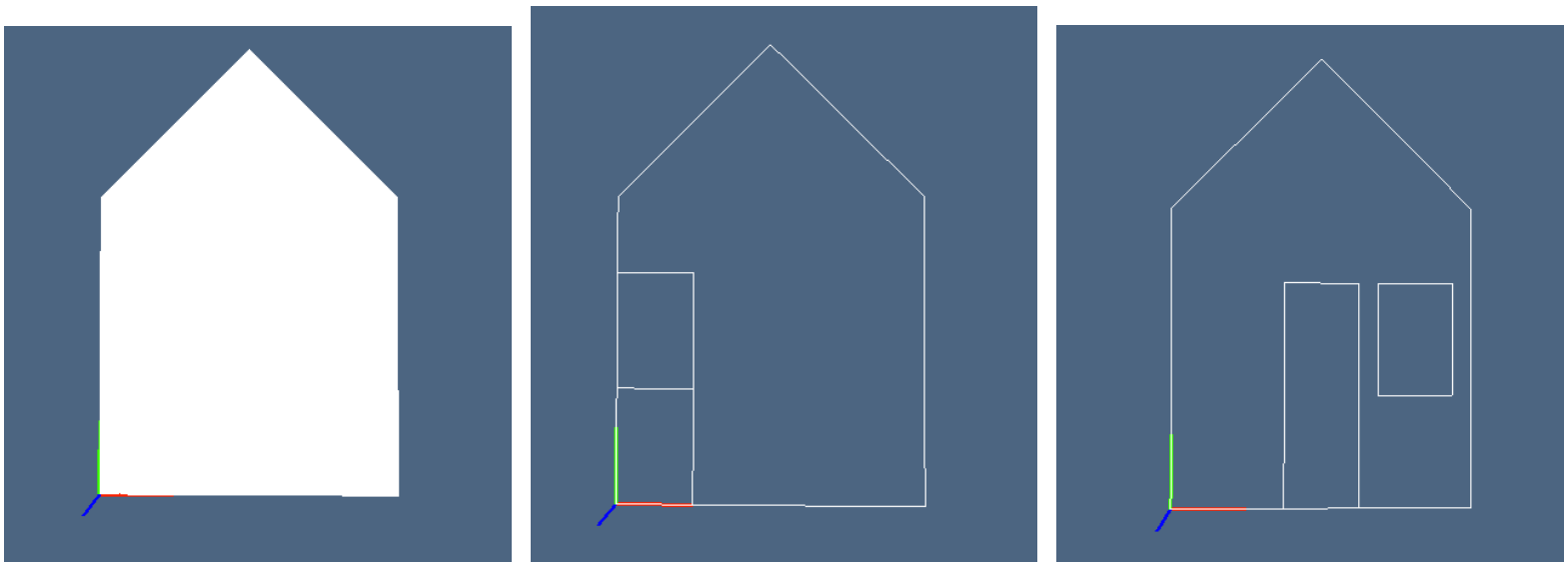

Figure : (a) three `hpc` values with a vertex on the origin; (b) their skeletons; (the translated skeletons)

Use of STRUCT primitives

STRUCTture: used to make an assembly of geometrical objects

introduced the COLOR(color)(obiect) primitive

```
house = STRUCT([muro, COLOR(RED)(T(1)(1.5)(door)),
    COLOR(GREEN)(T([1,2])([2.75,1.5])(window))])
VIEW(house)
```

using a Boolean operator

```
house = DIFFERENCE([muro, COLOR(RED)(T(1)(1.5)(door)),
    COLOR(GREEN)(T([1,2])([2.75,1.5])(window))])
VIEW(house)
```

Use of STRUCT primitives

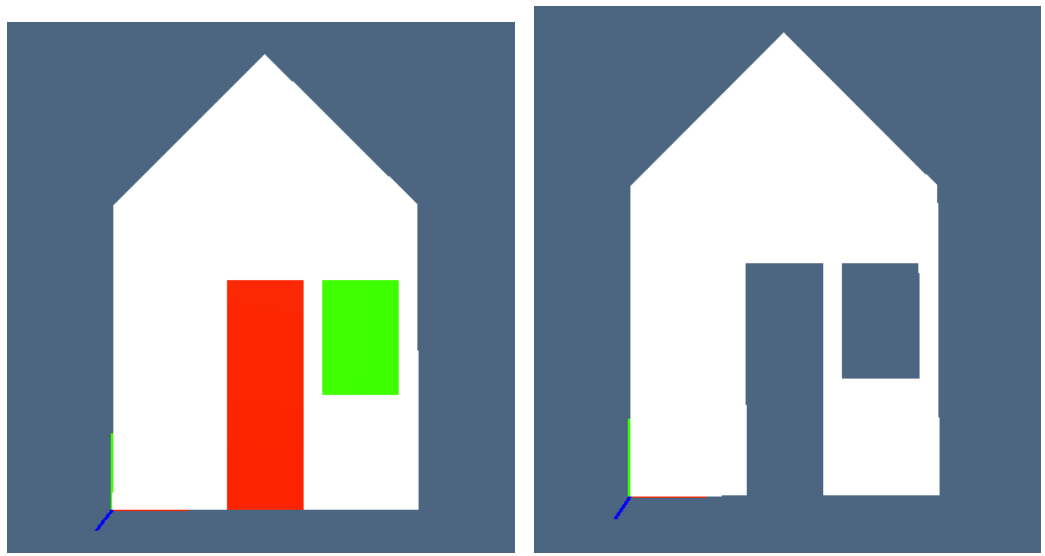

Figure : (a) using the `COLOR` primitive; (b) substituting `DIFFERENCE` for `STRUCT`

Use of PROD primitive

PROD: used to make the Cartesian product of geometrical objects (pointsets)

Cartesian product times an interval of size 4

```
house3D = PROD([house, Q(4)])    # properties (color) are lost
VIEW(house3D)
```

new assembly

```
muro = PROD([muro, Q(4)])
door = T(1)(1.5)(PROD([door, Q(4)]))
window = T([1,2])([2.75,1.5])(PROD([window, Q(4)]))
house = STRUCT([muro, COLOR(RED)(door), COLOR(GREEN)(window)])
VIEW(house)
```

Use of PROD primitive

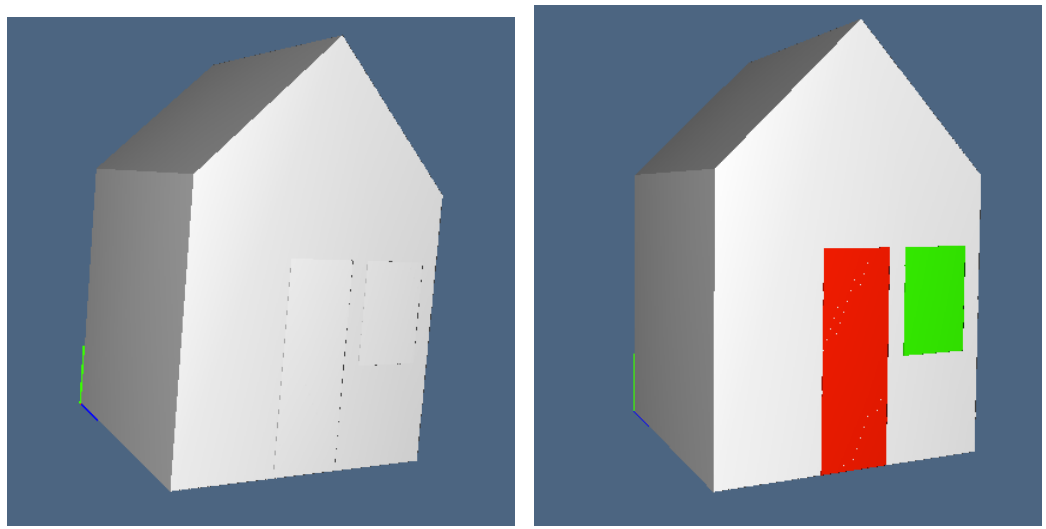

Figure : some solid operations loose the property values of assemblies

Advanced use of affine tensors within an assembly

PROD: used to make the Cartesian product of geometrical objects (pointsets)

$$\text{STRUCT}([Q, hpc_1, Q, hpc_2, \ldots, Q, hpc_n) \equiv$$
$$\text{STRUCT}([Q(hpc_1), Q^2(hpc_2), \ldots, Q^n(hpc_n))$$

```
pair_x = [T(1)(4), house]
houseRow = STRUCT(NN(10)(pair_x))
VIEW(houseRow)
```

assembly of assemblies

```
pair_z = [T(3)(14), houseRow]
neighbourhood = STRUCT(NN(10)(pair_z))
VIEW(neighbourhood)
```

Advanced use of affine tensors within an assembly

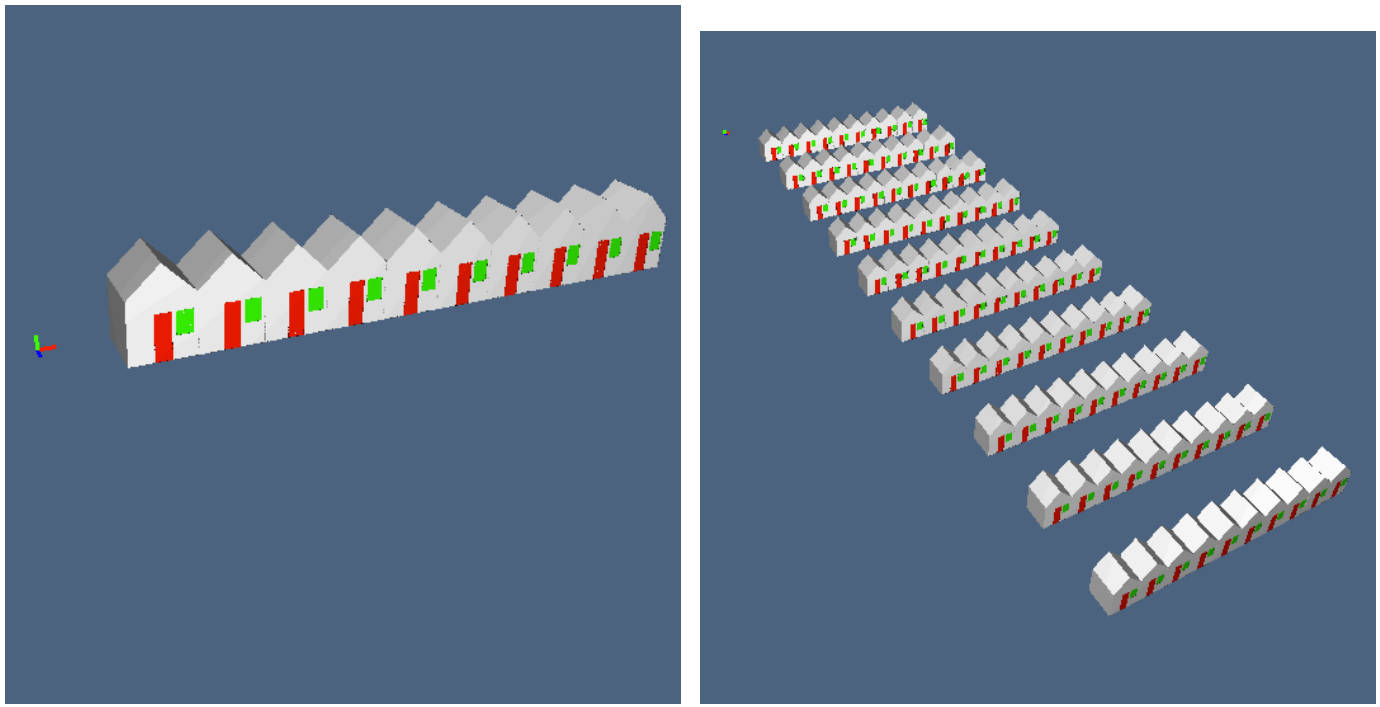

Figure : automatic composition of affine tensors within an assembly