

IBPSA Project 1 | Expert Meeting

Geometry Processing: *"garbage in 'n model out"*

Christoph van Treeck

Some core observations

Some core observations

Geometry processing between BIM and BPS

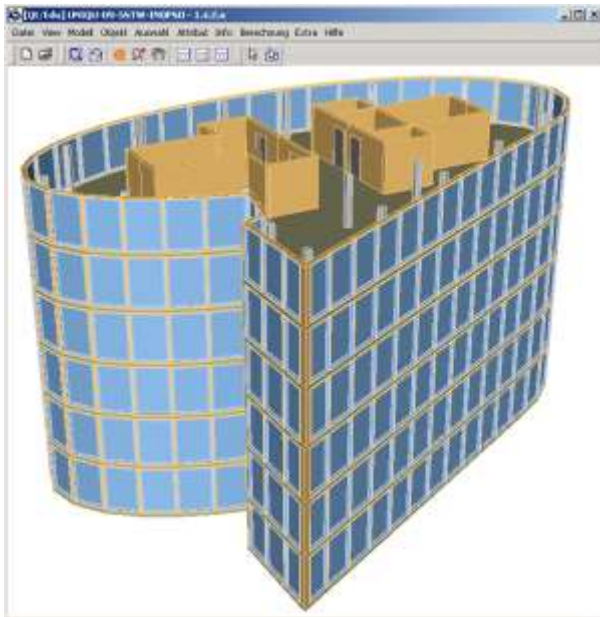
BIM model processing for BPS

- is tedious and error-prone
- requires many manual adjustments
- requires well-experienced modelers
- Proper model check and space definitions
 - are the precondition for automated space boundary algorithms to succeed
- Equal cost for proper model healing or complete redesign
 - means, better redraw your model, then you know what you get
- Typical CAD solution means reduction to 2D problem:
 - extract 2D floor plan, detect polygonal that circumscribes space in question
 - inherent 3D problems cannot be covered
- Conventional CAD typically supports ONE instance of a zone model only
 - engineering domains need various zone and system configurations (lighting, thermal, functional, etc.)
 - engineering domains have different granularities and follow geometrical, topological and/or logical constraints and rules

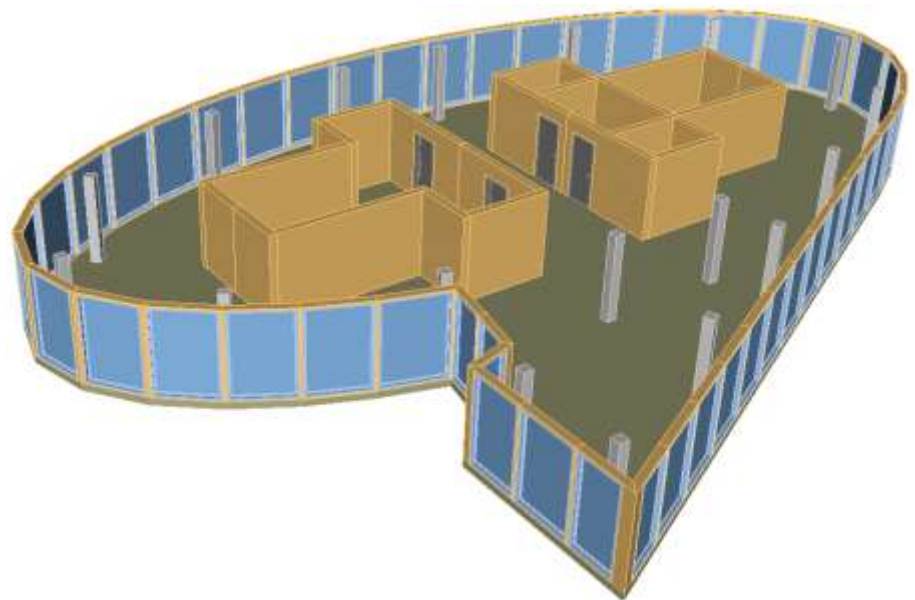
My vision:
"garbage in 'n model out"

Dimension reduction by proper model analysis

How to automatically detect spaces from an arbitrary IFC file without prior space or space boundary definitions?



IFC model

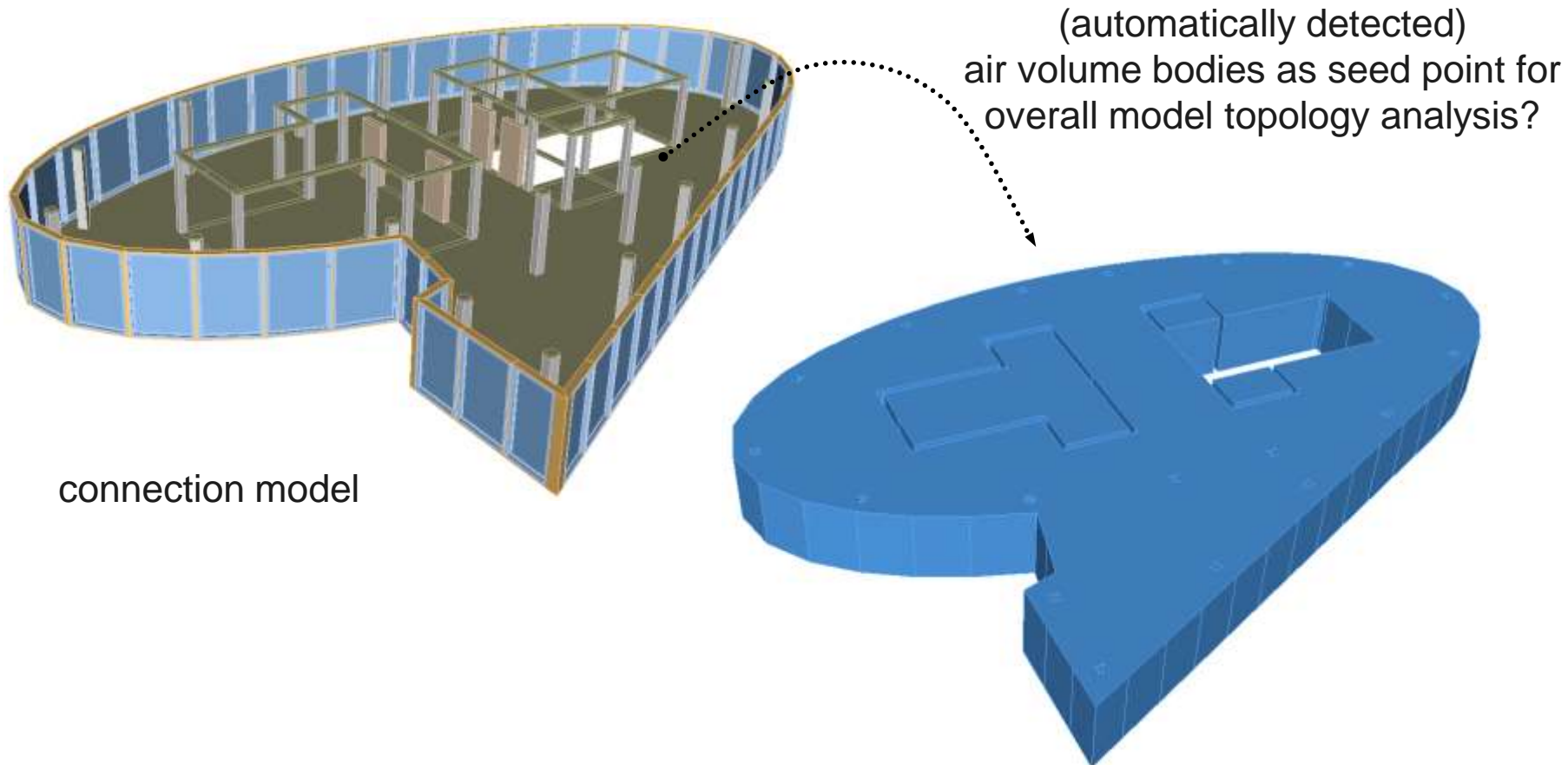


B-rep volume model (ACIS)

(van Treeck, PhD Thesis 2004; van Treeck, Engineering with Computers, 2006)

Dimension reduction by proper model analysis

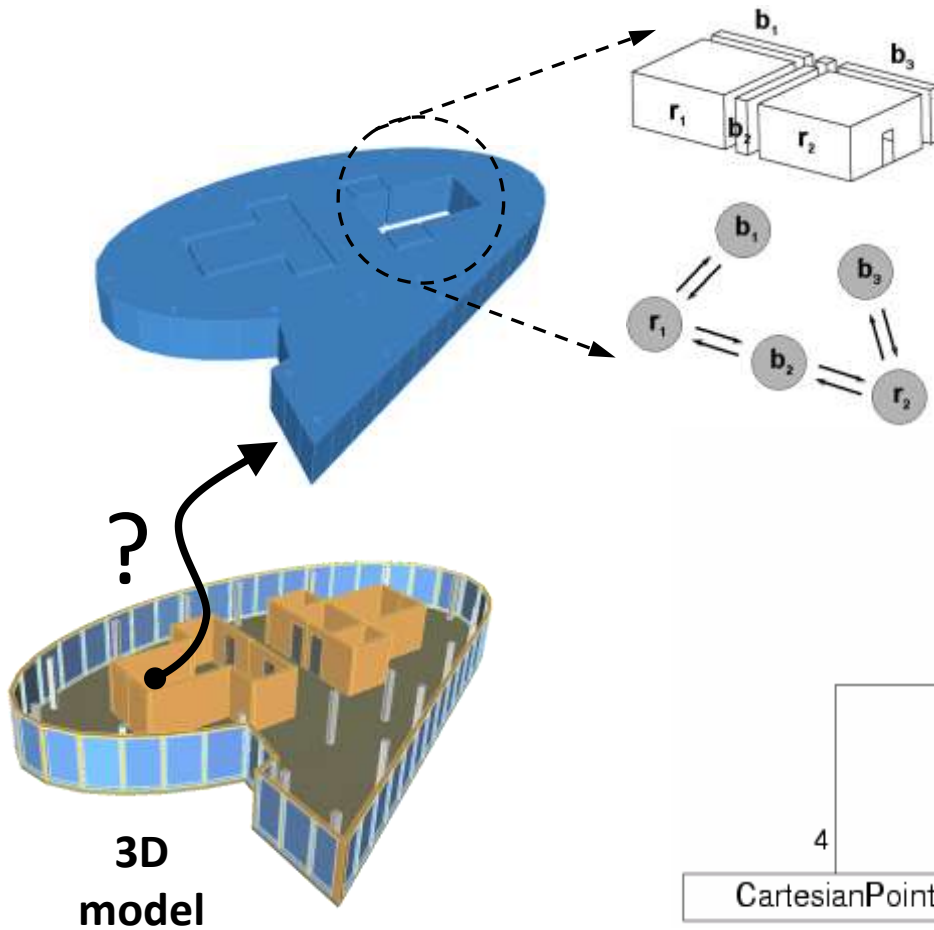
How to automatically detect spaces from an arbitrary IFC file without prior space or space boundary definitions?



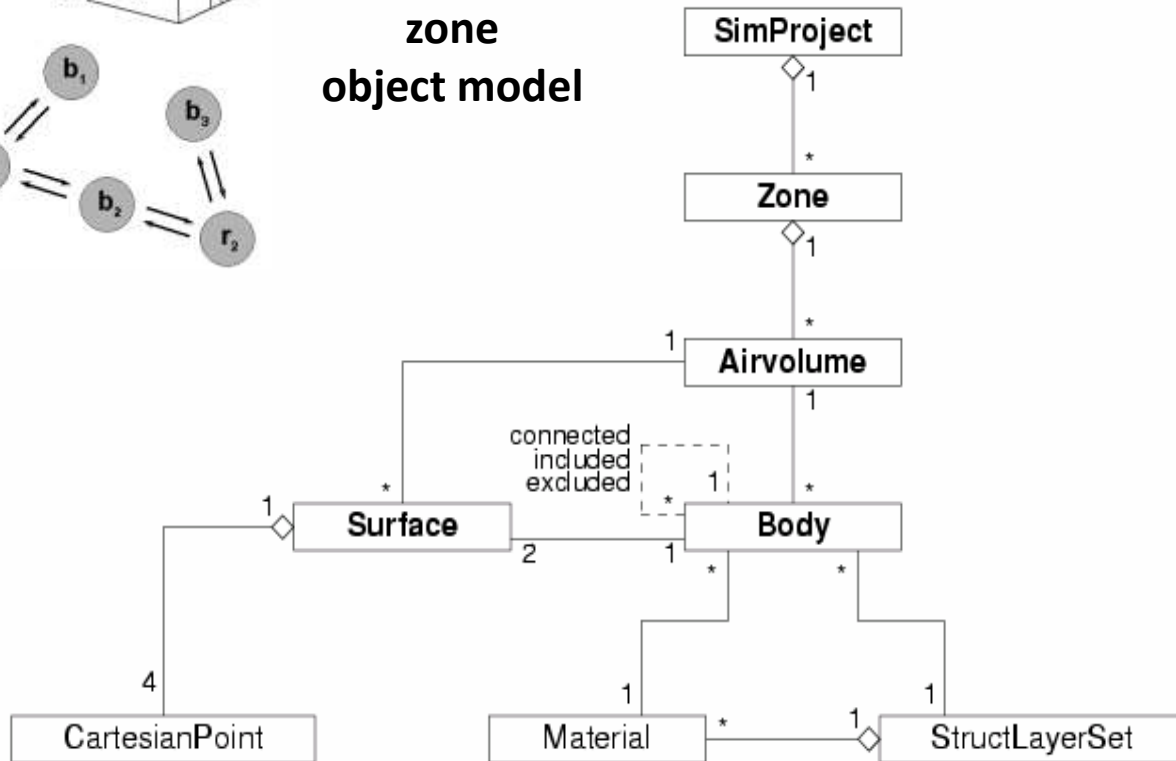
(van Treeck, PhD Thesis 2004; van Treeck, Engineering with Computers, 2006)

My PhD work (2004)

Graph theory-based model decomposition and analysis



zone
object model

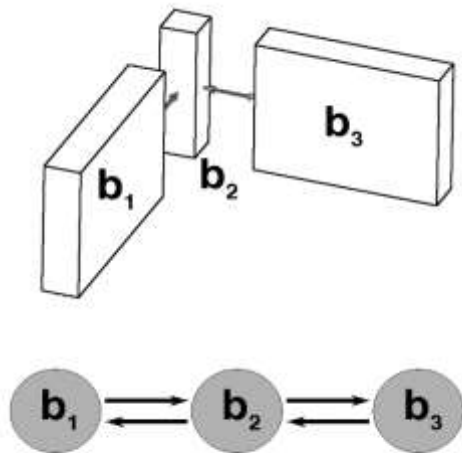


(van Treeck, PhD Thesis 2004; van Treeck, Engineering with Computers, 2006)

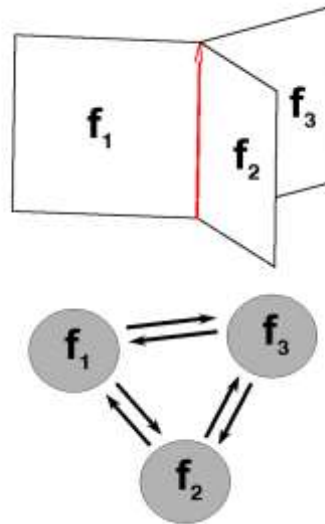
Graph theory-based model decomposition and analysis

Methodology

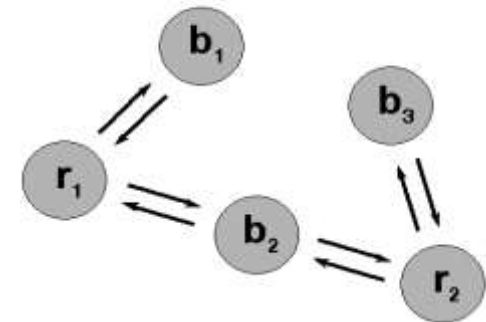
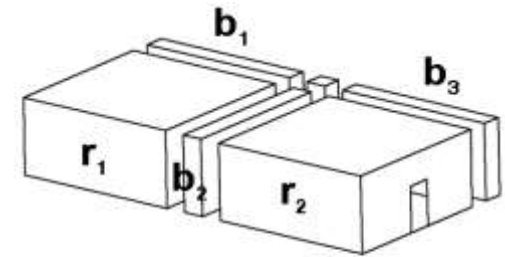
- Model decomposition
- Extraction of air volume bodies and building envelope surface
- Semantical identification of components



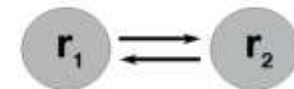
building components
connection graph



room surfaces
connection graph



relational object graph

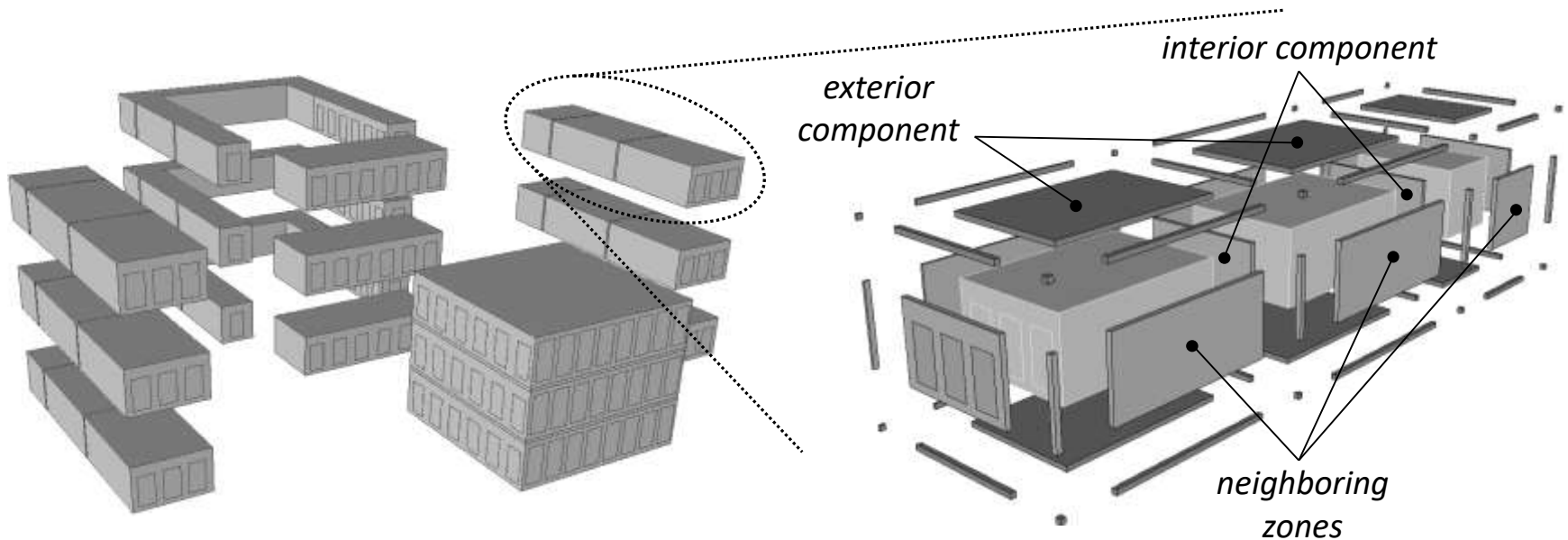


room neighborhood graph

(van Treeck, PhD Thesis 2004; van Treeck, Engineering with Computers, 2006)

Graph theory-based model decomposition and analysis

Grouping to zones and semantical identification



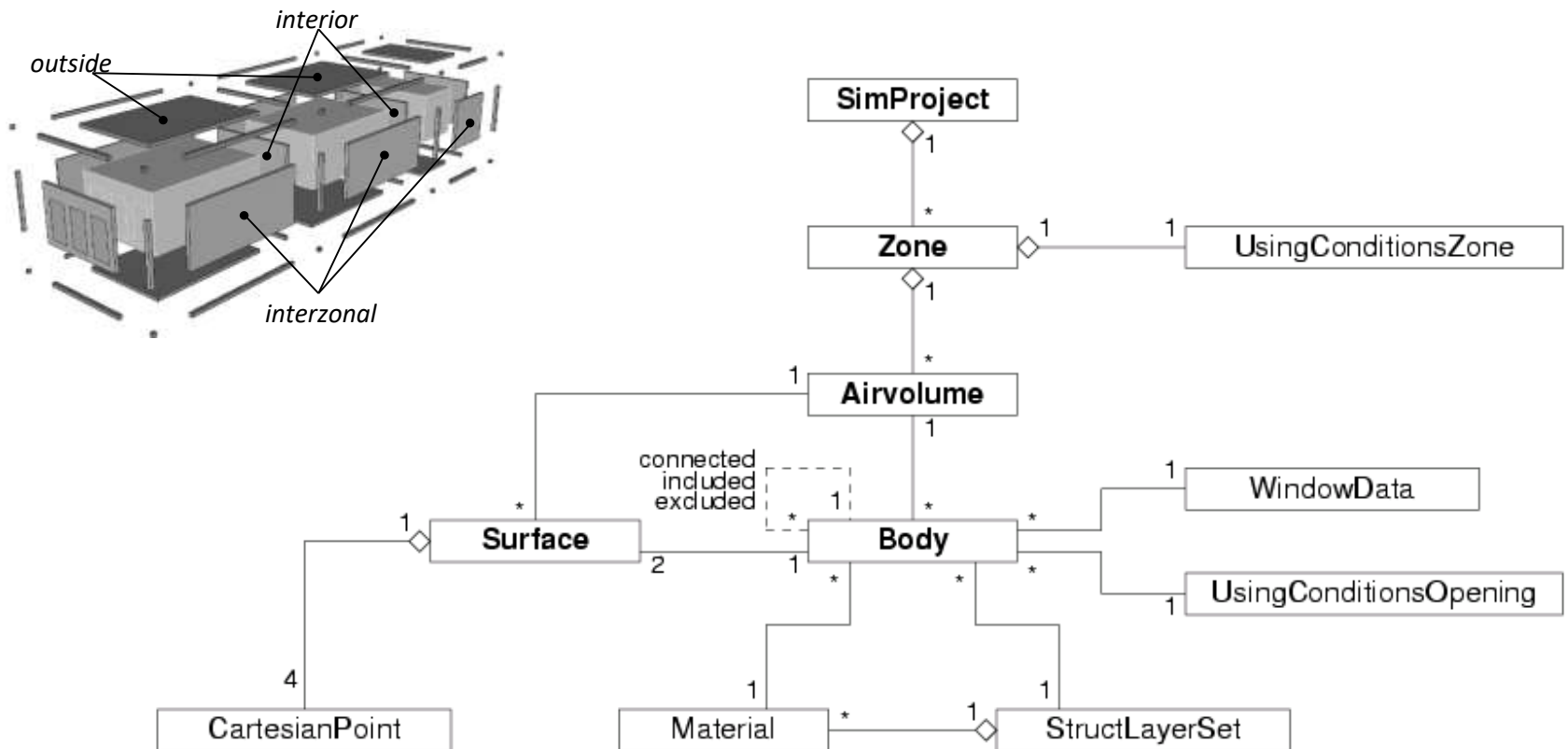
example:
zone generation as precondition for BPS

semantical identification of components
(interior/exterior walls etc.)

(van Treeck, PhD Thesis 2004; van Treeck, Engineering with Computers, 2006)

Graph theory-based model decomposition and analysis

Grouping to zones and semantical identification



(van Treeck, PhD Thesis 2004; van Treeck, Engineering with Computers, 2006)