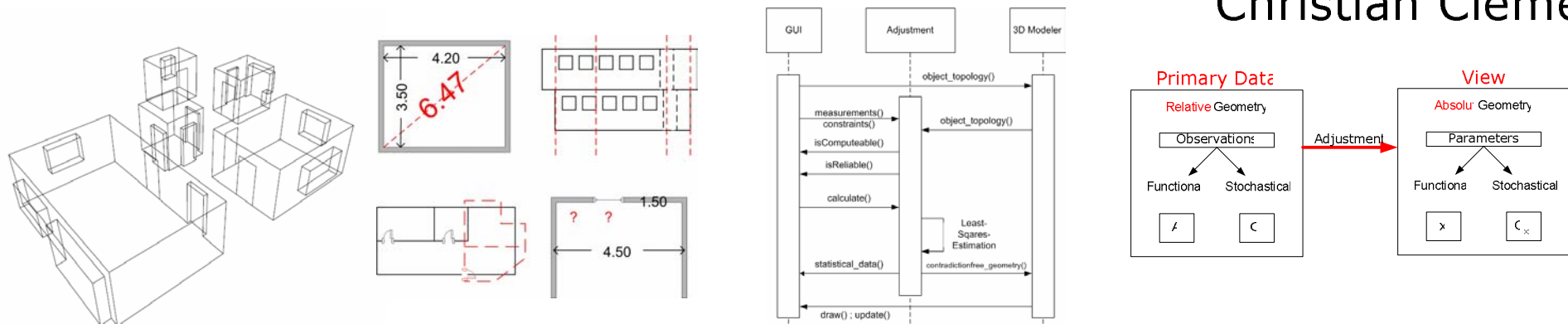


Reverse Engineering for generation of 3D-Building-Information-Models applying random variables in computer aided design.

- **As-Built Documentation**
- **Least-Squares-Estimation and CAD**
- **Measurement evaluation and CAD**

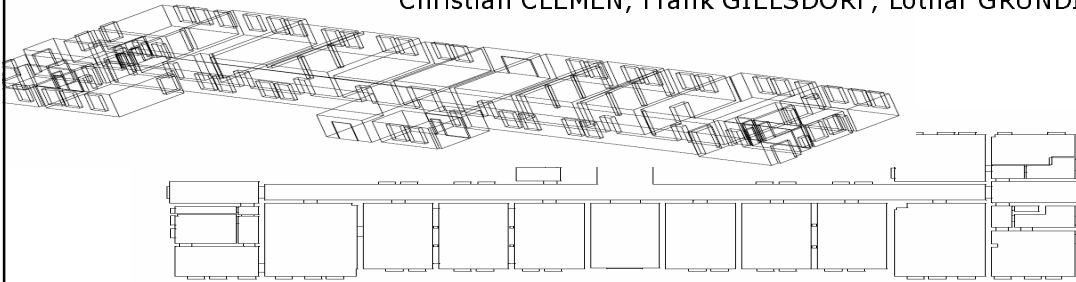


Christian Clemen



Reverse Engineering for generation of 3D-Building-Information-Models applying random variables in computer aided design.

Christian CLEMEN, Frank GIELSDORF, Lothar GRÜNDIG, Germany



A geodetic Building Information System (As-built Documentation)

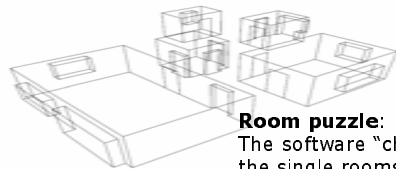
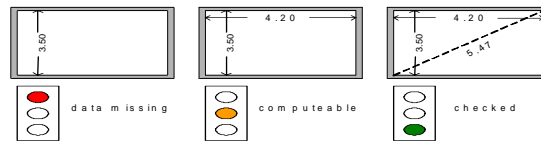
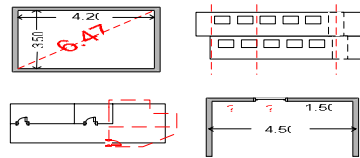
Motivation:

Common problems in reverse engineering for building-models:

The reference dimension does not fit, different floors do not fit, parts do not adjoin or single measurements are simply forgotten.

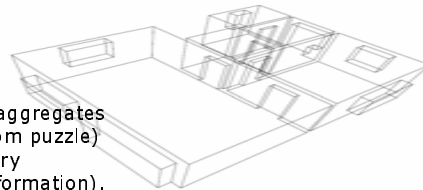
Avoid errors:

Obviously it is essential to collect data and to check the consistency at the same time! Therefore geodetic adjustment techniques have to be integrated into a data-collection-tool.



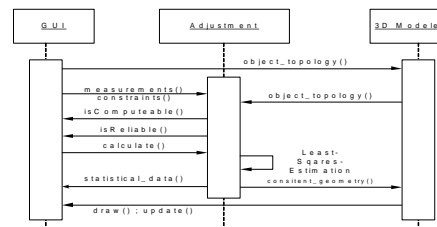
Room puzzle:

The software "checks in" room-files and aggregates the single rooms to a building model (room puzzle) by merging the topology and the geometry (topological matching, geometrical transformation).



Least-Squares-Estimation in CAD-Systems:

By integrating Least-Squares-Estimation into a CAD-Environment the user benefits from both approaches. The CAD handles the object topology and the consistent geometry, while an adjustment module handles redundant observations and geometric constraints.



CAD vs. SURVEYING

Thesis 1:

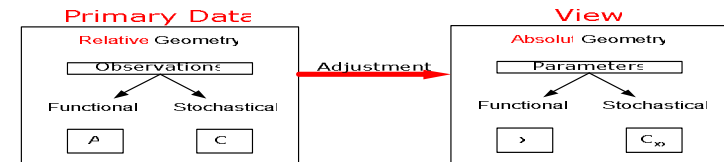
In CAD geometry-input is deterministic while "real" measuring-input should be modeled as **random variable**.

Thesis 2:

CAD is not suitable for reliable measurement evaluation, due to the need for **redundant measurement** values.

Thesis 3:

CAD uses the absolute geometry as **primary data**, whereas surveyors use the original relative geometry (measurements) instead.



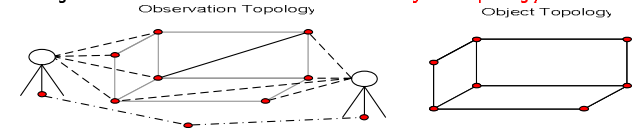
Thesis 4:

Highly redundant absolute geometry representation in CAD makes **adjustment** applications impossible.

BUILDING INFORMATION MODELS vs. GEODETIC NETWORKS MODELS

Thesis 5:

Geodetic analysis software alone is not suitable for reverse-engineering of buildings because it does not model the **object topology**.



Thesis 6:

Geodetic analysis software alone is not suitable for reverse-engineering of buildings because it assumes a discrete **point representation**.