As-built Documentation and Reverse Engineering Derived from Laser Scanning

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Project structure and project management

Common conditions:
- Data base related point cloud management
- Object oriented data processing
- Nodes, Edges, Polygons, Surfaces, Volume bodies
- As build documentation and related maintenance

North Pavilion – Big Colonnades  
Schloss Sanssouci

Feasibility study using laser scanning technology for cultural heritage purpose

RIEGL LMS Z360i environment scanner was used

Registration of the Scanner Stations Data

- Targets placed on the object
- Station linkage via non natural references placed in the scans
  - Cylinder
  - Sphere
- Object space references
  - Planes
  - Curved surfaces
- Iterative-Closest-Point-Method

Outlines

- Project structure
- Unique reference frame
- Tools for data processing
- Surface approximation
- Data acquisition of railway facilities
- Clearance simulation

Final products derived from the Laser scan data processing?
North Pavilion – Big Colonnades

Data Acquisition - 14 Scans

Processing tools

- Fitting of geometrical primitives like lines, circles, ellipses, planes, spheres, cylinders and cones
- Non completed point clouds fitting of circle and ellipses curves, sphere segments, parts of cylinders, cone obuse
- Fitting of cover elements for circle, sphere and quader (important for the segmentation - the so called functional patches)
- Fitting of smooth free form curves (NURBS)
- Comparison between the point cloud and the fitted element with deflections, measuring against CAD and false color visualization

Non Uniform Rational B-Spline (NURBS)

- NURBS have a precise and well-known definition.
- NURBS can accurately represent both: standard geometric objects like lines, circles, ellipses, spheres and tori, and free-form geometry like car bodies, other complex double curved surfaces also human bodies.
- The amount of information required for a NURBS representation of a piece of geometry is much smaller than the amount of information required by common faceted approximations
- NURBS can be implemented on a computer in a way that is both efficient and accurate.
**Generation of free form surfaces**

**Measuring distances between free form surfaces**

**Feasibility study Railway**

**3D Data - Restriction**

**Automated Rail Geometry Recovery (ARGR)**

**TLS for 3D Data Acquisition**

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**Microprocessor Forum**

Oct 13 & 14
Clearance drive through Simulation

Source DB-Net system specifications
Drive dynamic und clearance

TLS in 2D CAD Applications

Conclusions
Very high algorithmic complexity using adjustment with resulting accuracy and quality improvement

- Data reduction/filtering
- Point cloud Registration(Transformation) of the single stations in a unique reference system
- Calculation of planes and profiles
- Extraction of panoramas and Orthophotos
- Deduction of form functions

This in the highest possible degree of automation

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