

Scan Vs. BIM: Patch-Based Construction Progress Monitoring Using BIM and 3D Laser Scanning (ProgressPatch)

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SUMMARY

This paper presents a new method and experimental software for the automated construction progress monitoring. The use case scenario is to compare a given, as-planned Building Information Model (BIM) with the three-dimensional point cloud from a terrestrial Laser Scanner (TLS), acquired on-site during the construction process.

In contrast to other solutions the presented approach is plane-based not point-based. It reduces the large amount of data from the local point clouds to sparse set of plane parameters. These small plane sections are called “patches”. The error budget of the scanner, calibration and registration is known and can therefore be propagated to the parameters of the patches. The variance-covariance is considered in the statistical test procedures. The building model is reduced to BIM-component surfaces called “faces”. The actual construction progress is derived through a comprehensive comparison of scanned “patches” with BIM-“faces”. The developed algorithm considers the position of the laser scanner in the scene, which gives additional information on the visibility and emptiness.

As a prerequisite for the scan-vs-BIM comparison, a new method for the co-registration of the point cloud in the BIM-coordinate reference system was developed. This method automatically extracts planes from the building model. In plane-based registration, the entire point cloud is transformed into the BIM coordinate system.

The research results are validated using as-planned BIM and 3D point clouds from terrestrial laser scanning from a small ongoing construction site.

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