



Contribution ID: 65

Type: **not specified**

## Enhancing photogrammetric measurement systems through Gaussian Splatting

Photogrammetric measurement systems are widely adopted in manufacturing since they combine accurate geometric reconstruction, operational flexibility and relatively low implementation costs, while also supporting scalable and repeatable measurement workflows. However, photogrammetry is constrained by the initial image acquisition, since any extension of the dataset requires additional physical acquisitions. Recent advances in radiance-field methods, particularly Gaussian Splatting (GS), enable the creation of high-quality and fully navigable 3D scenes, allowing the extraction of renders (synthetic images) that can be integrated into the photogrammetric workflow.

This work investigates two potential benefits of integrating renders into conventional photogrammetry. First, it addresses data augmentation through synthetic views, as renders may represent a practical strategy for densifying the input image dataset without further physical acquisition. Second, the availability of a navigable scene enables the virtual capture of images from novel and controlled camera positions within a fully digital environment. In this sense, this second objective corresponds to the construction of a digital twin of the photogrammetric measurement system, with renders intended to mirror physical image acquisition while providing access to a theoretically unlimited range of virtual camera positions.

Preliminary results show that the progressive replacement of real images with renders introduces a systematic effect in the measurement. This study also includes the analysis of residual form errors, e.g., planarity and sphericity. It further examines the compensation of the observed systematic component through the introduction of a controlled perturbation term in the collinearity equation.

### Special/ Invited session

Mathmet: Digital twins for industrial machine vision systems and reference data generation

### Classification

Both methodology and application

### Keywords

Photogrammetry, Gaussian Splatting, Digital Twin

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