Wolfson School of Mechanical, Electrical and Manufacturing Engineering

A Calibration Procedure Based on Triangulation of a Scale Bar Artefact

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1. Introduction

Optical Motion Capture (OMC) systems are used increasingly in manufacturing due to their low cost, and good performance.

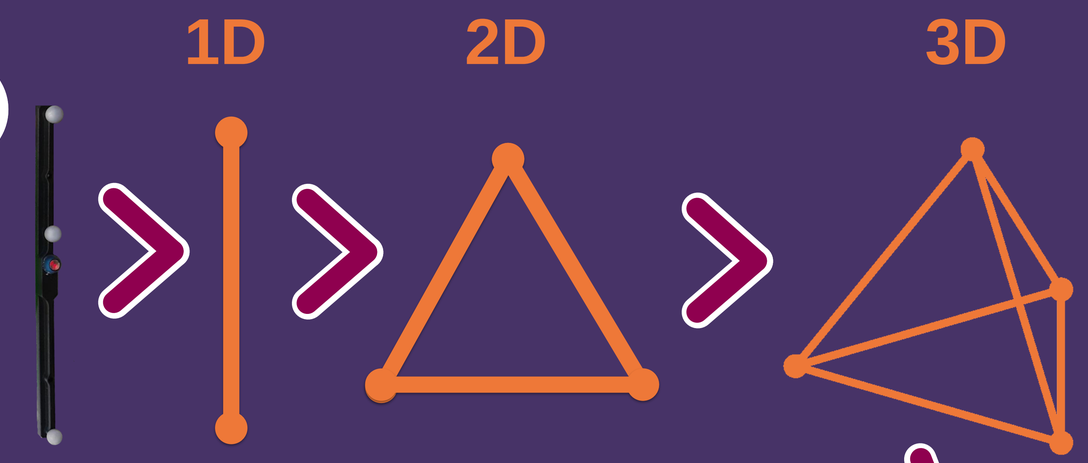
However, these systems can have systematic point-to-point errors, due to incomplete calibration, environmental changes etc [1].

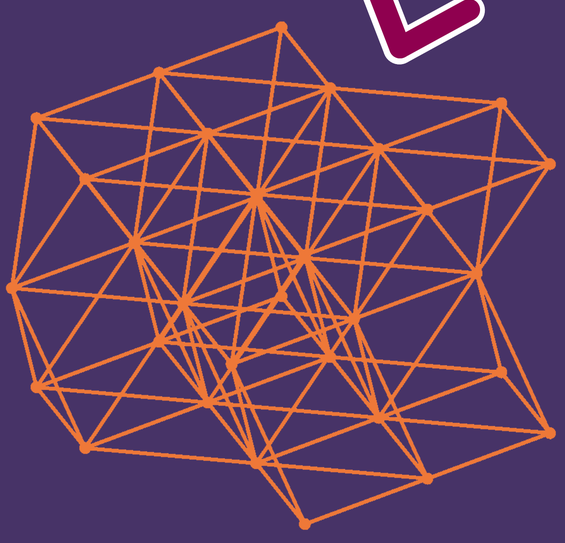
Methods of verifying these measurement systems or calibrating these errors out are generally expensive or slow [2].

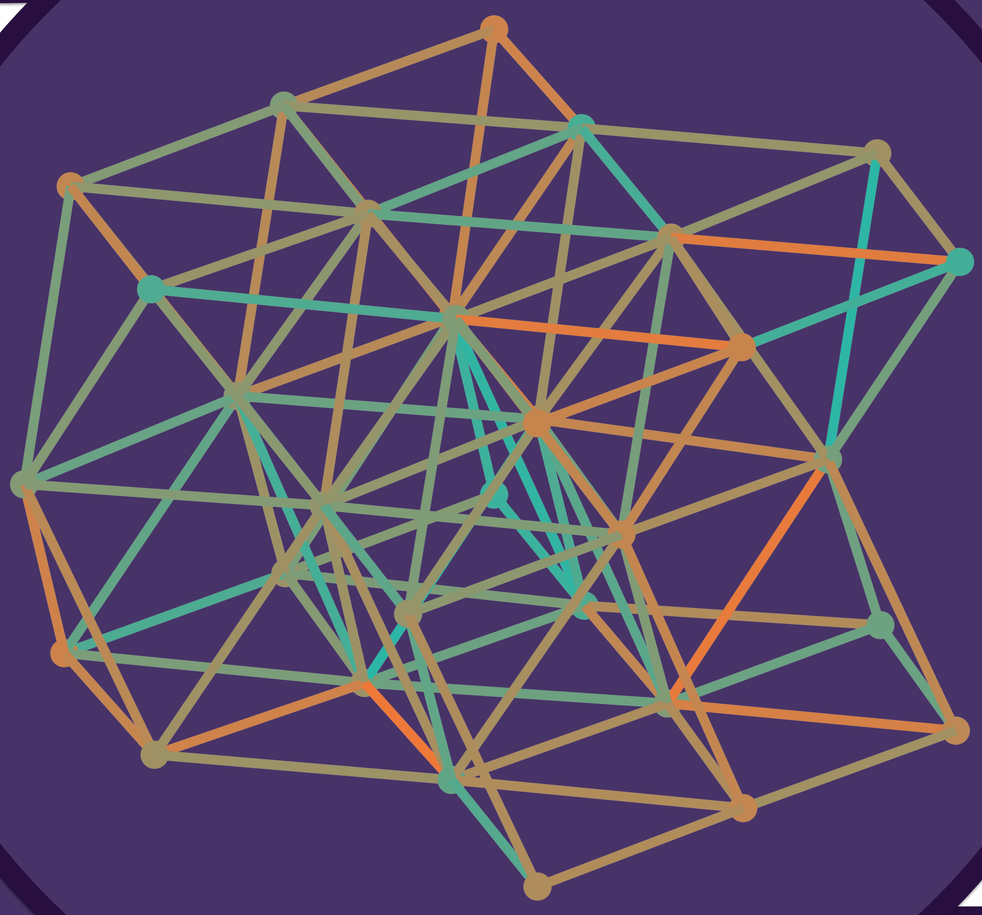
In this research, we propose a novel calibration procedure for OMC systems based on the triangulation of a single scale bar artefact.

2. Novel Approach

By measuring a scale bar in sets of triangles, we can create a scalable mesh of points in 3D with accurately known positions





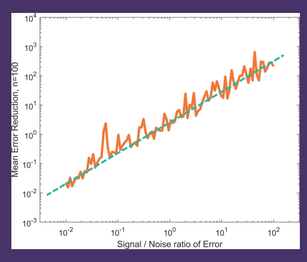


Relating the measured positions of each node in this mesh with the nominal positions, the systematic errors of the measurement system can be calculated

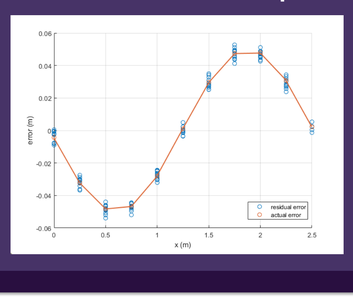
3. Simulation

A numerical simulation highlights the benefits of this approach:

The effectiveness is proportional to the error signal/noise ratio



This approach can identify even extreme error profiles



A variable mesh density can be used to span large volumes

4. Testing

The approach was used to apply corrections to our OMC system at the 3D Concrete Printing Lab at Loughborough University.

The approach identified the error of a 1x0.5x0.5m volume. After the correction was applied, the mean residual error was reduced by 30% from 1.40mm to 0.88mm when compared to measurements from an AT960 Leica Tracker.

5. Future Work

This approach offers a solution to verify the point-to-point accuracy of Large Volume Measurement systems without the need for a cumbersome artefact.

To improve the usability of this approach, custom artefacts could be developed, allowing for faster, and more automated calibration.

REFERENCES

[1] M. Windolf, et al., “Systematic accuracy and precision analysis of video motion capturing systems—exemplified on the vicon-460 system,” Journal of Biomechanics, vol. 41.

[2] Nagymáté G, Kiss RM. “Application of OptiTrack motion capture systems in human movement analysis: A systematic literature review,” Recent Innovations in Mechatronics. 2018;5(1):1-9.

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