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Developments in Multi-target, Wide Angle, Frequency Scanning Interferometry

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CMSC 2015 Abstract

Title: Developments in Multi-target, Wide Angle, Frequency Scanning Interferometry

We have developed a self-calibrating 3D coordinate metrology system capable of determining the locations of multiple sensors and targets simultaneously. Frequency scanning interferometry (FSI) is employed to measure the radial distance to multiple targets from multiple sensors. The radial distances are converted into coordinate locations through multilateration calculations. This allows for a self-calibrating system which incorporates compensation for systematic errors. Uncertainty estimates are computed online with every measurement. All results are traceable to the SI through the use of a reference gas cell. FSI measurements are sensitive to movements in both the sensors and the targets during a measurement. These effects are limited by employing a dual sweep FSI system.

We have previously presented results using divergent beam FSI to measure target distances. We have achieved operating volumes of ~1 m^3, however this is close to the maximum working volume achievable with a divergent beam system, while keeping the device eye safe. Divergent beam FSI will always be limited due to the amount of light "thrown away" in the projected beam. In order to operate over volumes of the order 5 m x 5 m x 2.5 m, a new method is required. We propose incorporating spatial light modulators (SLMs) to direct beams towards targets. We have developed an SLM sensor head capable of detecting targets up to a range of 10 m and over 30˚ off-axis. Multiple beams can be steered simultaneously allowing multiple target detection. We present initial results from a working prototype, discuss some of the issues arising from SLM target detection, and future goals of the system.

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