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Development of digital twins in metrology for a stereovision system

Machine vision systems are important in Industry 4.0 as they allow fast automated inspection and quality control. Traceable metrology for machine vision systems is critical for the digital transformation of the Industry 4.0 objectives defined by the EU Green Deal. Nevertheless, these systems currently lack well-defined uncertainty frameworks and calibration techniques. For contactless 3D scanning of large volume mechanical parts and form error assessment, a structured light stereovision system is developed based on the active stereovision principle. The system is mounted on a positioning industrial robot with 6 rotational axes fixed on one additional translational guiding stage. A number of traceable high accuracy multilateration systems were also used for the validation of the extrinsic parameters. A digital twin architecture is presented for automating the calibration process and optimizing the measurement strategy based on environmental factors surrounding stereovision systems, assuring traceability and increasing accuracy. Digital Twin in metrology is proposed as a digital model of a measurement process connected to the physical system by a closed loop, then providing the associated measurement uncertainty for a given measured value traceable to the meter unit definition. They enable virtual testing and validation by linking the digital and physical domains, paving the way for more effective, and efficient adoption of stereovision technologies in industrial settings. The proposed framework is centred around metrology, where system positioning decisions are based on the lowest measurement uncertainty.
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Special/ Invited session

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Mainly methodology

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