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Electrical tunable lens assisted phase unwrapping

Three-pattern imaging method delivering faster, higher-precision 3D microscopy with extended depth of field.

Researchers at Purdue University have developed an advanced phase unwrapping method for large depth-of-field (DOF) microscopic structured-light 3D imaging. This method enhances the efficiency of 3D imaging by reducing the number of required fringe patterns. Traditionally, achieving large DOF in microscopic 3D imaging has been hindered by the need for multiple focus settings and fringe images, often requiring up to 15 fringe patterns. Unlike conventional methods that necessitate acquiring additional images, the proposed method leverages prior knowledge from hardware and uses just three phase-shifted fringe patterns, improving data acquisition and processing speed without the need for additional image acquisition.

Technology Validation:

The method was tested using 3D structured-light systems and reduced the number of required fringe patterns from 15 to 3. Results demonstrated that the method efficiently reconstructed 3D coordinates over a larger DOF by calculating phase and fringe contrast maps from multiple focus settings. The approach achieved a DOF of approximately 2 mm. A prototype system was developed, and performed high-quality measurement for the depth range of approximately 1,000 mm (400 mm â€“ 1400 mm) with the measurement error of 0.05%

Advantages:

-Enhances DOF

-Reduces imaging time

-Improves object detail capture and speed of 3D microscopic imaging

Applications:

-Micromanufacturing

Technology ID

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Category

Artificial Intelligence & Machine Learning/AI-Integrated Imaging Systems & Industrial Vision and Inspection
Artificial Intelligence & Machine Learning/3D Optical Imaging & Industrial Metrology
Robotics & Automation/3D Perception & Modeling for Automation

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View online

-Precision measurement

-3D optical sensing/imaging

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Intellectual Property:

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Keywords: High-efficiency 3D imaging,Large depth-of-field microscopy,Structured-light 3D scanning,Rapid 3D data acquisition,Phase unwrapping technology,Precision microscopic reconstruction,Optical 3D measurement,Fringe pattern optimization,Industrial 3D sensing,Micromanufacturing inspection,Fast 3D optical metrology,Depth range imaging,Advanced microscopy imaging,High-speed 3D visualization