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Hybrid calibration procedure for fringe projection profilometry based on stereo vision and polynomial fitting

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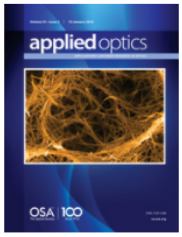

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Abstract

The key to accurate 3D shape measurement in fringe projection profilometry (FPP) is the proper calibration of the measurement system. Current calibration techniques rely on phase-coordinate mapping (PCM) or back-projection stereo vision (SV) methods. PCM methods are cumbersome to implement as they require precise positioning of the calibration target relative to the FPP system, but they produce highly accurate measurements within the calibration volume. SV methods generally do not achieve the same accuracy level. However, the calibration is more flexible in that the calibration target can be arbitrarily positioned. In this work, we propose a hybrid calibration method that leverages the SV calibration approach using a PCM method to achieve higher accuracy. The method has the flexibility of SV methods, is robust to lens distortions, and has a simple relation between the recovered phase and the metric coordinates. Experimental results show that the proposed hybrid method outperforms the SV method in terms of accuracy and reconstruction time due to its low computational complexity.