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# **A low-cost multi-modal medical imaging system with fringe projection profilometry and 3D freehand ultrasound**

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## **Abstract**

The growing need to perform surgical procedures, monitoring, and intervention of greater precision have led to the development of multimodal medical imaging systems. Multimodal images are a strategy to overcome the limitations of medical imaging technologies by combining the strengths of individual modalities or technologies. In this work, we propose a low-cost multimodal system that combines 3D freehand ultrasound with fringe projection profilometry to obtain information from the external and the internal structure of an object of interest. Both modalities are referred to a single coordinate system defined in the calibration to avoid post-processing and registration of the acquired images. The freehand ultrasound calibration results are similar to those previously reported in the literature using more expensive infrared tracking systems. The calibration reproducibility at the center point of the ultrasound image was 0.6202 mm for 8 independent calibrations. We tested our system on a breast phantom with tumors. Encouraging results show the potential of the system for applications in intraoperative settings.

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