



Contribution ID: 245

Type: Oral Presentation

Birefringence from digital phase-shifting measurements

Tuesday, 27 July 2021 12:15 (15 minutes)

Measuring phase differences between orthogonal polarisations has become a common industry practice. In food and drug production the circular birefringence exhibited by chiral molecules has been used to identify and measure the concentrations of enantiomers, while linear birefringence has been used in stress and biological imaging. Conventional techniques regularly rely on stressing photo-elastic materials to produce birefringence in order to measure the same phenomenon. We demonstrate how holographic phase shifting induced by a digital micro-mirror device (DMD) can be used to acquire spatially resolved arbitrary birefringence measurements. Linear and circular birefringence in both static and dynamic liquid crystal optics, metasurfaces as well as chiral sugar solutions were measured through maximum-likelihood estimation fitting. The acquired images have resolutions dependent purely on the camera used and the entire measurement process involves no moving parts. The polarisation and wavelength independence of DMDs as well as high refresh rates and relative low cost makes the technique a promising digital candidate for applications in industry.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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Session Classification: Applied Physics

Track Classification: Track F - Applied Physics