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Imaging waveguides using optical diffraction tomography
MELISSA MEISTER, AMY SULLIVAN, Agnes Scott College — Optical Diffraction Tomography measures changes in the index of refraction of a material rather than its light absorption. Therefore, this method can be used to quantitatively characterize objects that do not absorb light, such as waveguides. Better characterization of these objects and the materials from which they are created is necessary for the development of integrated optical systems. Unlike traditional imaging techniques, our system allows for imaging of micron-scale, low index contrast 3-dimensional structures that are deeply embedded in a polymer. The 3-dimensional target object is replicated at equal intervals to create a diffraction grating. A laser beam interacts with the grating to form a 2-dimensional diffraction pattern which we measure in the far field. This scattered electric field is directly related to the Fourier transform of the object's index profile. Taking data for a range of incident beam angles allows for the recreation of the 3-dimensional object. We demonstrate images of waveguides embedded in photopolymers with micron-scale resolution and a high signal-to-noise ratio.

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