LightTrans' Talks at SPIE Optics & Photonics 2020

Modeling of Diffractive-/Metasurfaces and Their Performance Evaluations in General Optical Systems

Optical Modeling and Performance Predictions XI
– Session 5: Gratings, Holography, Modulators, & DOEs/Meta-Surfaces
Monday, 24 August 2020 | 14:40 – 15:00 PTD
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Diffractive- and metasurfaces have gain notable success in recent years and optical devices such as diffractive- and metalenses are shown to be quite useful for many applications. They are both defined as thin structured layers on a surface which is usually flat, and the difference between them lies in the scale of the structure: sub-wavelength range in the case of metalenses, wavelength range for diffractive. The expected functionality of such components is to produce a change in the incidence wavefront phase. Additional electromagnetic phenomena, like amplitude and polarization changes, can and do occur, and they must be considered in the modeling so to evaluate the overall performance of the system. Speaking of the modeling of diffractive- and metasurfaces, people often seek for rigorous solutions like the FDTD or FEM approaches which turns out to be computationally too heavy when applied to the whole devices in their actual dimensions. Or, sometimes people may simply apply approximated method like the thin-element approximation, which is however limited for paraxial cases only. We will present a physical-optics-based approach to deal with the modeling of the whole diffractive-/metasurfaces, by decomposing the input field into numbers of sub-fields and studying the interaction of each sub-field with a local extension of the surface. Such kind of local interaction can usually be done with rigorous approaches without demand of much computational resources. Examples on meta-gratings and diffractive-/metalenses will be presented. Besides the modeling of a single component, we will also demonstrate the inclusion of such devices in the modeling of a complete optical system.