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Advanced modeling of a moderate-resolution holographic spectrograph

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Abstract

© 2017 Optical Society of America. In the present article we consider an accurate modeling of a spectrograph with a cascade of volume-phase holographic gratings. The proposed optical scheme allows us to detect spectra in an extended wavelength range without gaps, providing relatively high spectral resolution and high throughput. However, modeling and minimization of possible cross-talk between gratings and stray light in such a scheme represents a separate task. We use analytical equations of the coupled-wave theory together with rigorous coupled-wave analysis to optimize the gratings parameters and further apply the latter together with a non-sequential ray-tracing algorithm to model propagation of beams through the spectrograph. The results show relatively high throughput up to 53% and the absence of any significant cross-talk or ghost images, even for ordinary holograms recorded on dichromated gelatin.

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