Image Edge Enhancement Technique Using a Novel Optical Vortex Filtering

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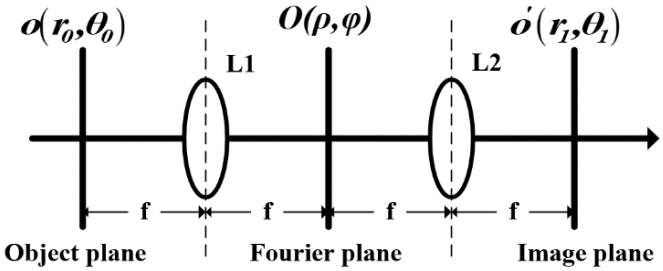
Abstract

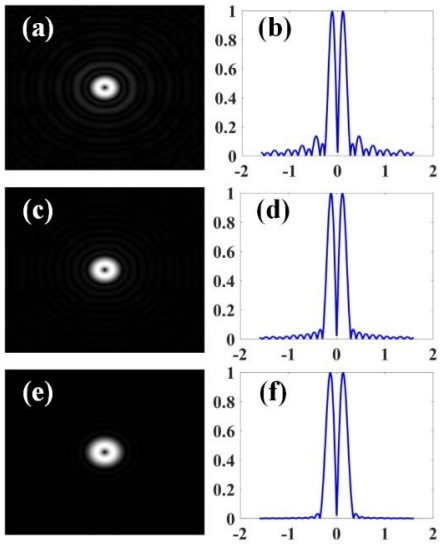
This paper proposes a new approach to producing optical vortex filter by using a Sinc function, called the Sinc spatial filter (SSF). We prove that the SSF can realize a high contrast edge enhancement.

Design

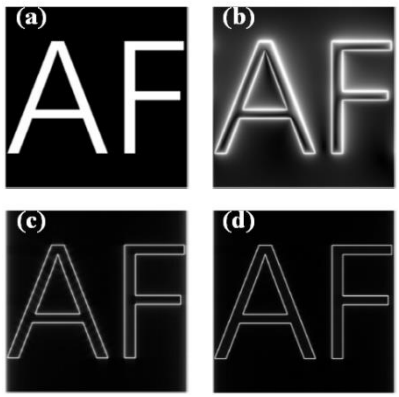
In order to eliminate background noise of vortex filter, we propose a novel vortex filter based on the Sinc function, and put the optical vortex filter on the Fourier plane of a 4F system.



Simulation result



The PSFs of the SPP, the LGSF and the SSF filters are simulated and given in (a), (c), (e), and (b), (d), (f) are the corresponding radial profile distribution. Comparing with the amplitude characteristics of the PSFs of the SPP, the LGSF and the SSF, the noise is further suppressed in (e) and (f).



In the experiment, the picture contained letter “AF” was taken as the sample to compare the output images of edge enhancement of three different filters, as shown in the picture above. It can be seen from (b)~(d) that all the three filters can produce isotropic edge enhancement. However, compared with the SPP and the LGSF, the background filtered by the SSF has almost no noise, more sharp edges, and high contrast.

Acknowledgment

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