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DE's focusing in a circumference. Numerical study of their performance

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Diffractive elements focusing in a circumference have been computer-generated by means of computer-generated-hologram methods. The hologram of a circumference has been calculated from 3D integrated techniques. These techniques integrate the field of the designed focus so that saving computer time and attaining better accuracy.

The study of diffractive elements performance have been made up from the numerical reconstructions of light in the designed focal region. These numerical reconstructions have been obtained by means of Kirchoff's diffraction theory. In order to study the performance of the diffractive elements, we have consider three quality parameters: focal dispersion of light (FD), signal–to–noise ratio (SNR) and diffraction efficiency (DE), that have been defined by,

$$\mathrm{FD} = \sigma, \qquad \sigma^2 = \frac{1}{G}\int_D I(P)\,(P-Q)^2\,dP\,, \qquad G = \int_D I(P)\,dP\,,$$

where P is a point on the focal plane D, $I(P)$ is the intensity of light in the point P and Q is a point on the design focal circumference;

$$\mathrm{SNR} = \frac{S}{G-S}\,, \qquad S = \int_R I_F(Q')\,dQ'\,,$$

where $I_F(Q')$ is the intensity of light in the point Q' on the designed focal region R; and

$$\mathrm{DE} = \frac{S}{L}\,, \qquad L = \int_E I_0(M)\,dM\,,$$

where $I_0(M)$ is the input intensity of light in the point M on the diffractive element E.

By means of these quality parameters, different performance of the diffractive elements have been obtained with respect to: different kind of diffractive elements (intensity transmittance, phase transmittance and intensity–phase transmittance), different levels of quantization, changes of reconstruction wavelenght and two different size of circumference radius (greater and less than size radius of the diffractive element).

Some examples of diffractive elements are presented as well as the comparative study of their performance.