DIFFRACTIVE ANALYZING AND IMAGE PATTERN DESIGN OF THE THREE-DIMENSIONAL IMAGING GRATING

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In many fields of optical research, such as optics transmission, medical image forming, and three-dimensional data storage, the technology of forming the images of several layers of space simultaneously is needed. So far there are varieties of methods to realize the function; for example, we can get lens array image with the lens of different image-forming condition, or form the image with beam splitter and a single lens. The shortage of the lens array method is that as the image-forming conditions of the lens are different it could be very difficult to adjust the entire system. To overcome the shortage of the methods above, the three-dimensional images of the space with different layers should be formed with periodical gradual changing grating (shown as Fig.1)\[1\]. As shown in Fig.2, it can form the images of three plains in the space on the imaging plain simultaneously, this is because the beam splitting effect (beams of different diffractive level) and beam focusing effect of the periodical gradual change grating. The optical system with the grating keeps the resolution of the lens in every image, and matches the serial of images with adequate accuracy. The principle of curved grating with gradually changing periods is presented, and it’s diffraction characteristic and imaging characteristic are analyzed in this paper. Then the trace of the grating indent is described by the indent equation. And the graphic pattern of the grating mask is designed according to the equation.

By running the program with Matlab, we can get the periodical gradual change grating image with given parameters(Fig 3, Fig.4). The periodical gradual change grating could be regarded as the linear addition of Fresnel wave zone, or the off-axis Fresnel wave plate. On diffraction aspect, the diffractive levels of the same abstract value function like convex and concave with the same focus distance. On image forming aspect, the detector with the grating can form separate images of objects at different distance on the same axis.

REFERENCES