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Apodised Optical System In The Presence Of Shrink apertures For Two-Line Resolution

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ABSTRACT

The optical system having an apodised circular aperture suffering from the effects of spherical aberrations. Analytical investigations have been carried out on the intensity distribution of the Two-Line objects in the image plane by primary spherical aberration. Studies were also made on the imaging characteristics of the optical systems subjected to spherical aberration. The individual influence of the apodisation, spherical aberration on the Two-Line Resolution have been examined.

I.INTRODUCTION

Generally the optical systems can be classified into three different categories such as: ideal optical systems, perfect optical systems and real optical systems. An ideal optical system is that in which both diffraction and aberrations are completely eliminated. Hence, an ideal optical system gives a point image of a point object and straight-line image of a straight line. That means the image and objects should be in a projective relation to each other. In the investigations on the general resolution problem in optical systems ARSAC [1956] has discussed the problem with Fourier integral theory.

II. MATHEMATICAL FORMULATION

When the optical system is apodised, each point gives rise to a diffraction image whose normalized amplitude response to unit amplitude in the object point. f(r) is the chosen amplitude filter. In the present study the following filters are employed: $f(r_1)= \cos(\pi\beta r)$ Hanning Amplitude Filter , $f(r_2) = (1-\beta r)$ – Bartlett Filter, $f(r_3) = (1-\beta r^2)$ – Shaded Aperture Filter and $f(r_4) = \sin(\pi\beta r) / \pi\beta r$ – Lancoz Filter and c is the intensity ratio between the Two Lines and Z_0 is distance of separation the integral 0 to 1 is indicating the aperture shape is circular.

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$$B(Z)=\left|\begin{array}{l}2\int_0^1 f(r)\cos[2\pi(Z+Z_0)x]e^{-i\left(\phi_s\frac{x^4}{4}\right)}dx\\+2c\int_0^1 f(r)\cos[2\pi(Z-Z_0)x]e^{-i\left(\phi_s\frac{x^4}{4}\right)}dx\end{array}\right|^2$$

Diffraction theory is mainly concerned with the field in these spatial regions; such regions signify greater practical importance as they include that part of the image space in which the optical image is situated. In the neighborhood of the focal plane, the light distribution will be much more complex in nature than the one suggested by geometrical optics. To describe the object, the diffraction pattern can be used since it is related to the shape, size and orientation of the object. The diffraction theory of image formation is the foundation in many modern applications of optics.

III.RESULTS AND DISCUSSIONS

In the following figures the resolution is occurred in the case of shrink apertures at 0.9 of the obscuration parameter ε but in the remaining figures i.e. from fig 2 to fig 6 the resolution disappears at this case the distance between the two lines are at $Z_{0}=2.5$ and the defocusing parameter and the spherical aberration and coma are π, 2π, 3π/2 in the fig 4 at the same obscuration parameter there is no resolution at all

As the aperture is shrinking to the value 0.7 we can observe that there is no resolution appears for all the values of the apodisation

we can see the resolution for the cases of 0.9 and 0.8 but in the case of 0.7 in the fig 12 the resolution will not get it is because of the shrinking of the aperture and it occurred in the case of the all the filters which are mentioned in the above cases.

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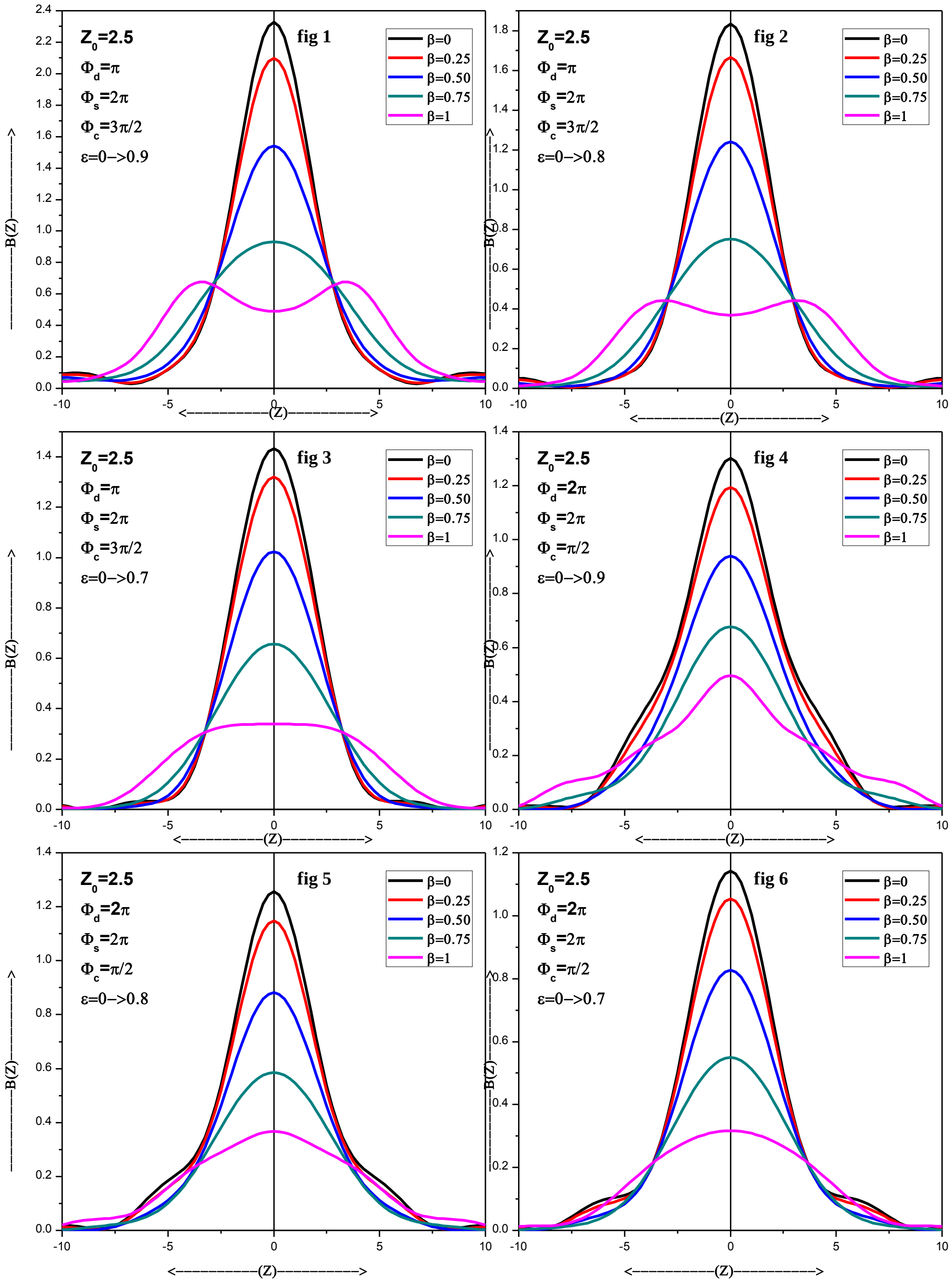

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