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Two-Line Resolution of Shrink Apertures in the Presence of COMA

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

I. INTRODUCTION

In the investigations on the general resolution problem in optical systems [RAMSAY et al 1940, 1941] extended the arguments of the theory of resolving power to include the intensity epoch slope. TORALDO DE FRANCIA [1955] introduced the sampling theorem criterion and 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 a unit amplitude in the object point the values of peripheral obscuration parameter ε will take 0.9, 0.8, 0.7 and 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

$$B(Z) = \left| \begin{array}{l} 2\int_0^{\varepsilon} f(r)\, Cos\{(Z+Z_0)r\}dr \\ +2c\int_0^{\varepsilon} f(r)\ \ Cos\{(Z-Z_0)r\}dr \end{array} \right|^2$$

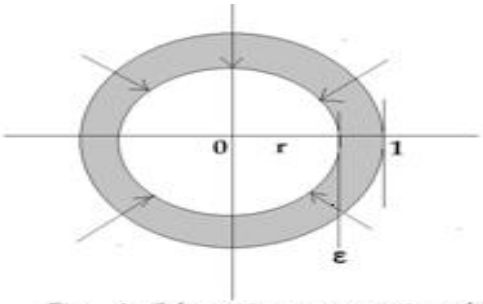

Fig A: Schematic representation of Shrink aperture

Fig –A represents the Schematic representation the Shrink Apertures where the aperture size is shrinking as the value of ε will take 0.9,0.8,0.7 the studies have been investigated in the presence primary coma with the parameters intensity ratio and the distance of separation between the Two lines.

III. RESULTS AND DISCUSSION

When the optical system is subjected to primary coma aberration and the intensity ratio c for the values in the range 0 to 1 in the increments of 0.2 the Fig.1 depicts the distance of separation between the Two-Line objects Z_0 = 3 and the optical system is at high degree of apodisation β = 1 for all the values of c the resolution is occurred for the Hanning Amplitude filter for the remaining three filters for the same condition the resolution is only for the values of c only at the condition c = 1.

For the intensity distribution profile for the distance of separation between the Two Line objects placed at Z_0 = 3 the resolution has occurred in the fig 5 when the Optical system is at high degree of apodisation β = 1 and the coma aberration is at Φc = π. The barlett filter in the fig 6 and the shaded aperture filter in the fig7 and Lancoz filter in the fig 8 the resolution occurred in the case of Z_0 = 3

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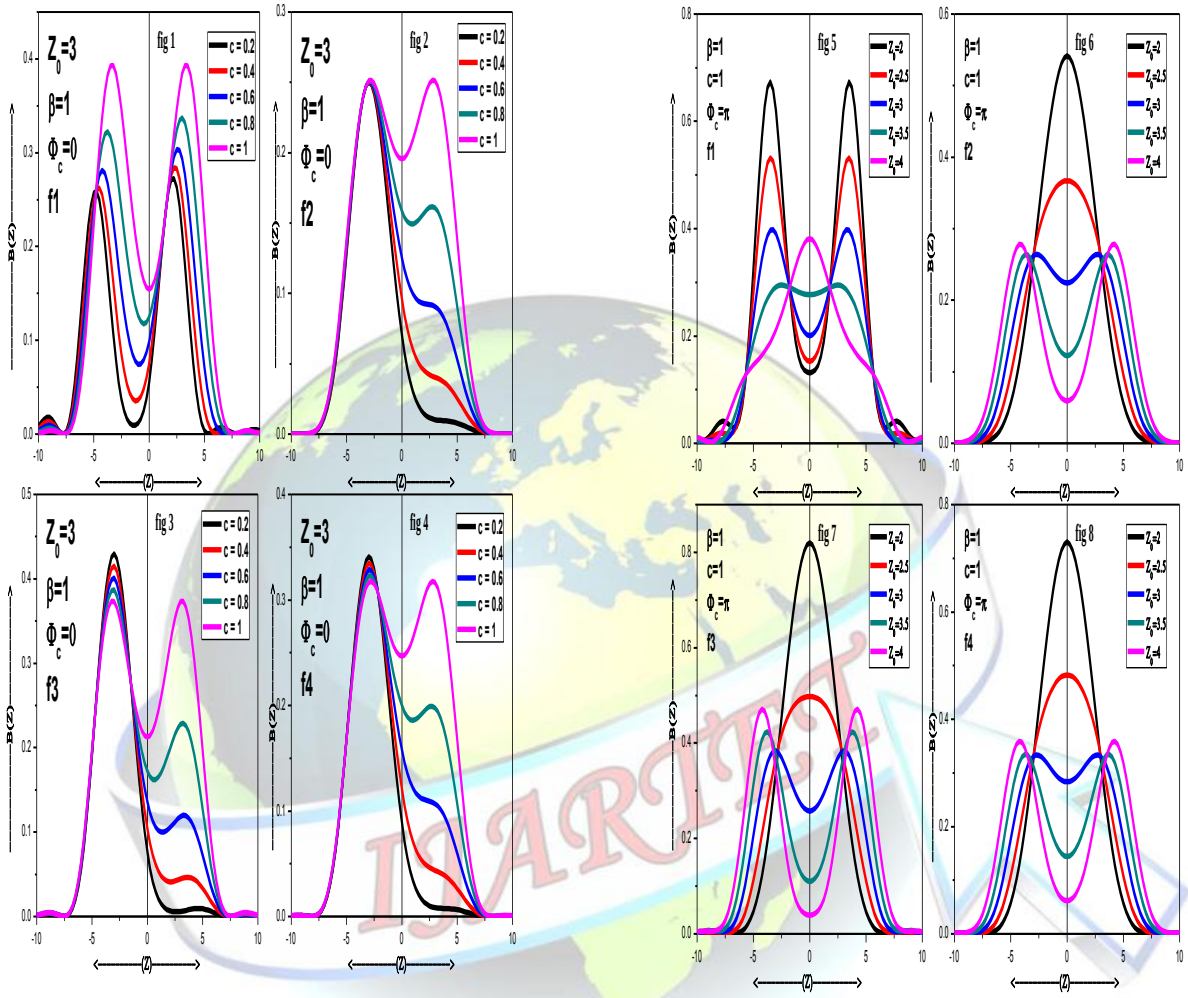

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