Four Slit Interference

Purpose:
1. To investigate the intensity of light on a distant screen due to the interference of four point sources.
2. To gain practice working adding sinusoidal waves using phasors

Introduction:

The light intensity, $I(\theta)$, due to light of wavelength, λ, passing through four narrow slits can be determined by taking into account the phase differences between the waves arriving at a point, P, on a distant screen (see Figure 1). If the point is located at an angle θ with respect central line of symmetry of the viewing screen and slits, the sum of the four waves from each slit (point source) can be found by using phasors to represent each light wave.

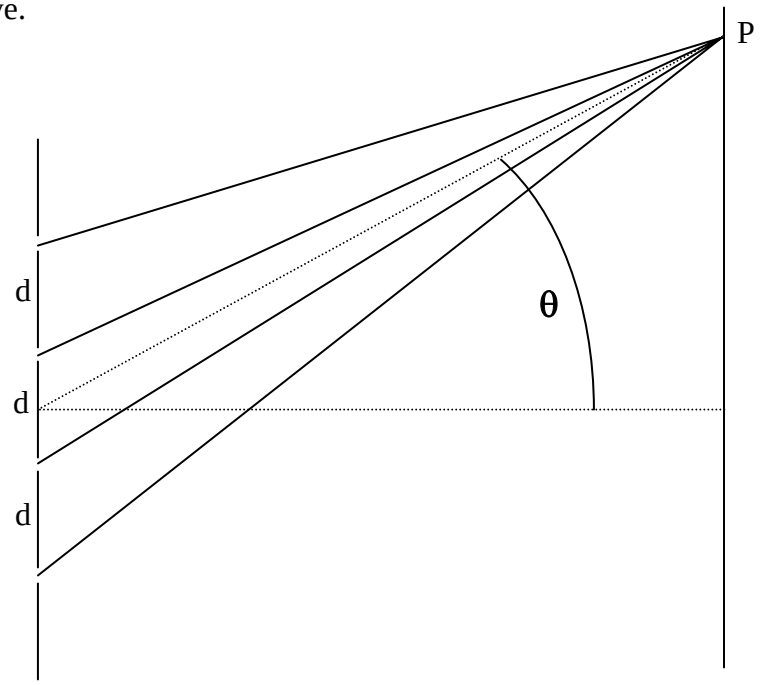

Figure 1

Procedure:

1. Make a careful phasor diagram showing the phasor for each of the four waves arriving at P. Find the resultant phasor, E_R, in terms of d, λ, and θ. **Hint**: Take advantage of the symmetry in your phasor diagram.
2. Find $I(\theta) = k E_R^2$ (k = a proportionality constant). Put your answer in terms of the intensity, I_0, the intensity of light passing through each individual slit.
3. Assume that $d = \lambda$ and use graphical analysis (or Excel) to create a polar graph of $I(\theta)$ vs θ ($0 \leq \theta \leq 2\pi$) to show how the intensity varies for different angle. Set $I_0 = 100$ to establish a relative scale for the intensity function.
4. Determine the location of all of the minimas and maximas of $I(\theta)$ between 0 and 90 degrees.