Cihan University, Erbil

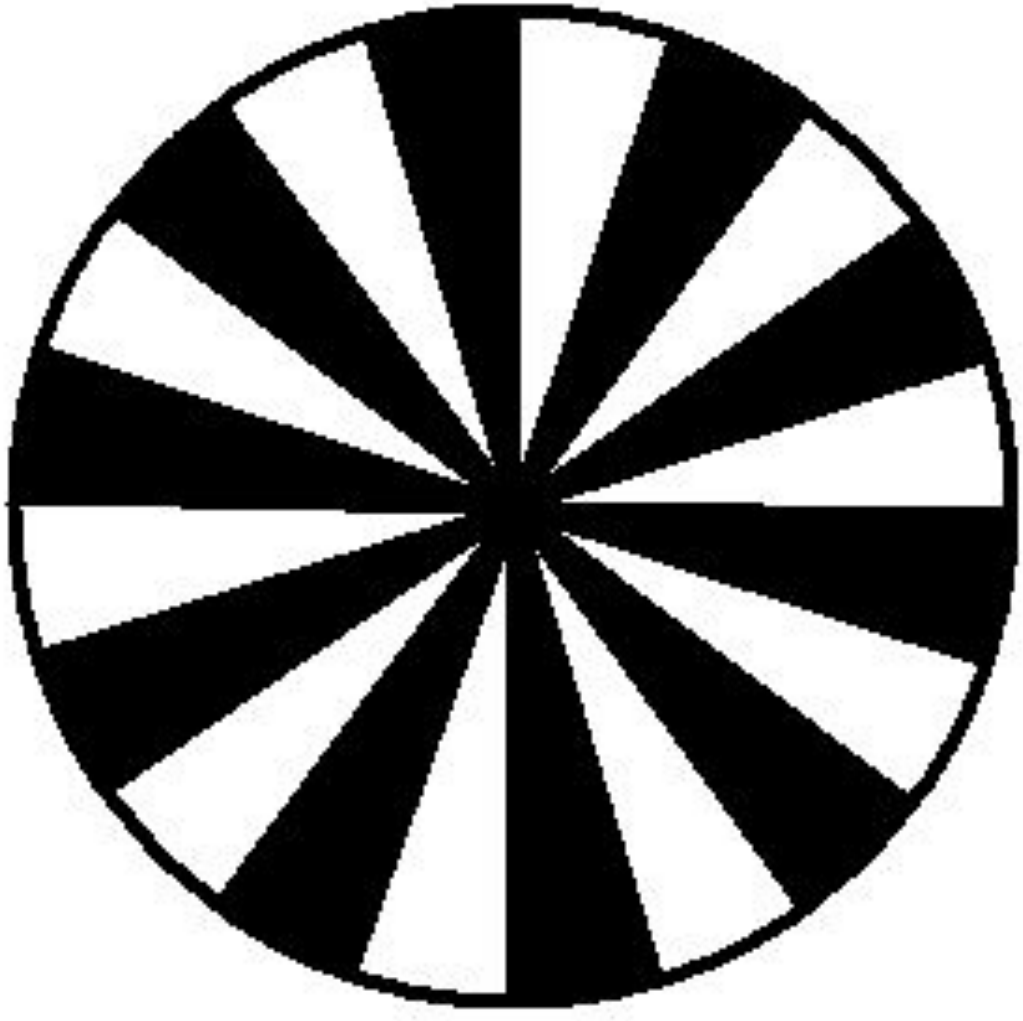
Design and Analysis Optical Modulator

Asst. Prof Dr. Abdulrazak A S Mohammed

Communication And Computer Engineering Department

Definition

- Modulator : It is an electro optical device used in electro optics system in order to modulate the optical signal



Names of Modulator

- There different name or title of the modulator:

1-Optical Modulator

2-Reticle

3-Chopper

4-Coding Device

- There are many electro- optical tracking systems using the optical package of electromagnetic radiation spectrum which can be various types use to cover many of the civilian and military applications, these systems are classified into two types depending on the nature of work

Type of the Modulator

1-As it work function :

a-passive-mode

In this mode the target represent as a source of energy for radiation

b-Active mode

In this mode the target is illuminated by an external source of lighting .

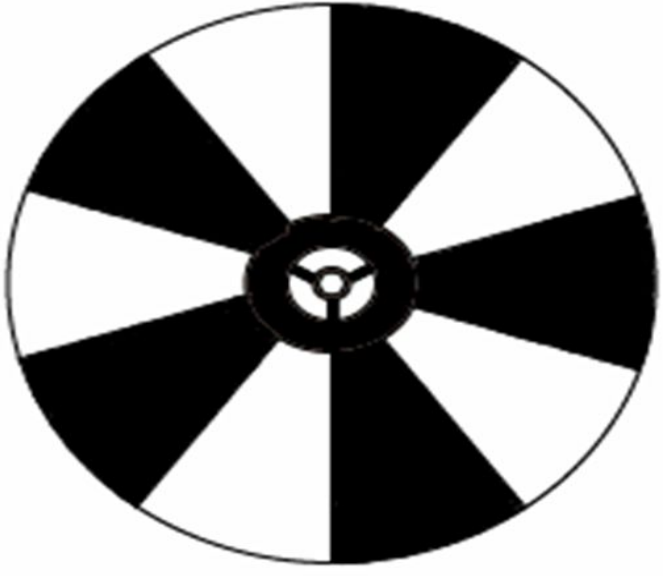
2- As it's function (Frequency):

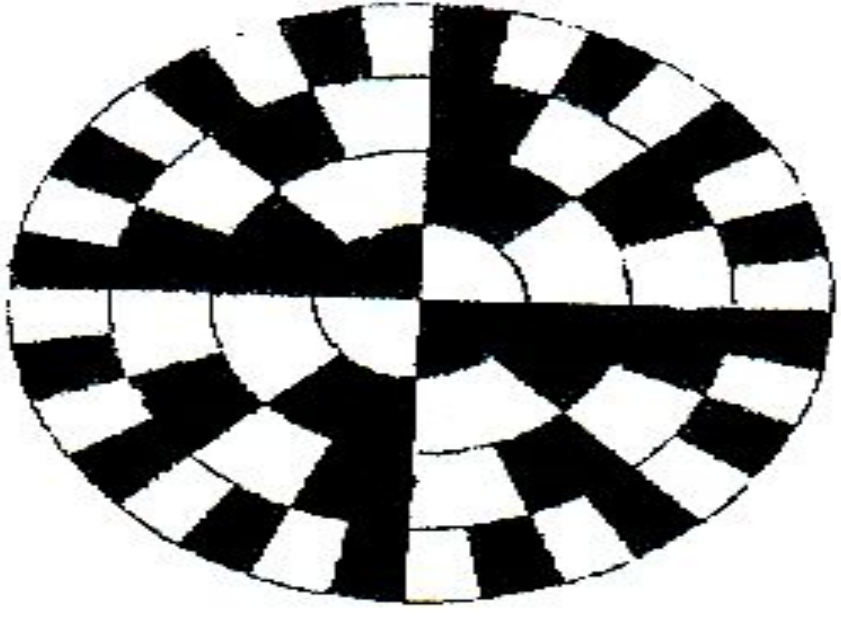
a- ***Amplitude Modulation (AM)***

b-Frequency Modulation (FM)

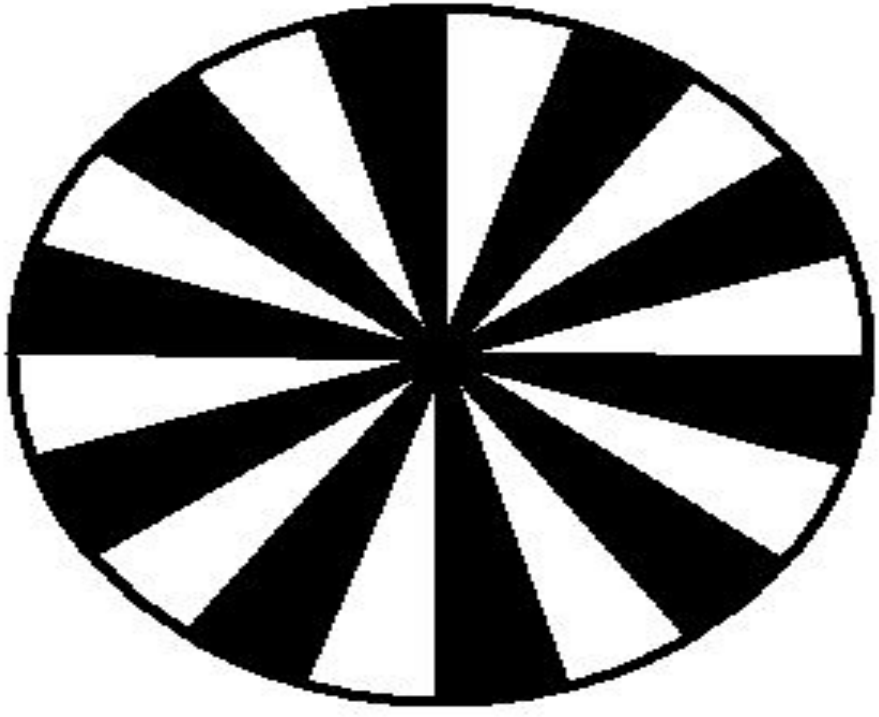
c-Pulse (Phase) Modulator (PM)

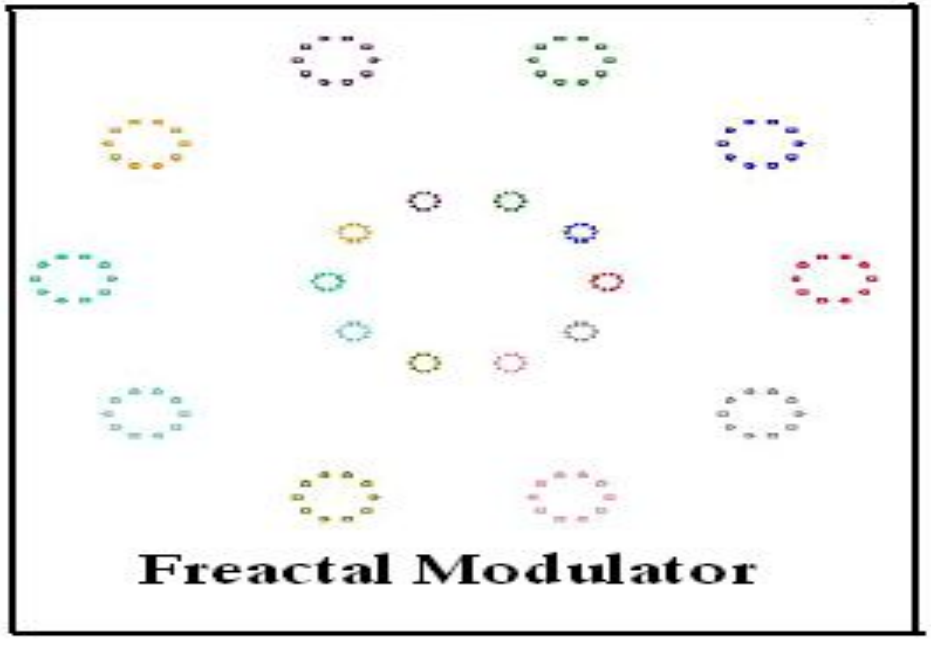
Type of Modulator Pattern

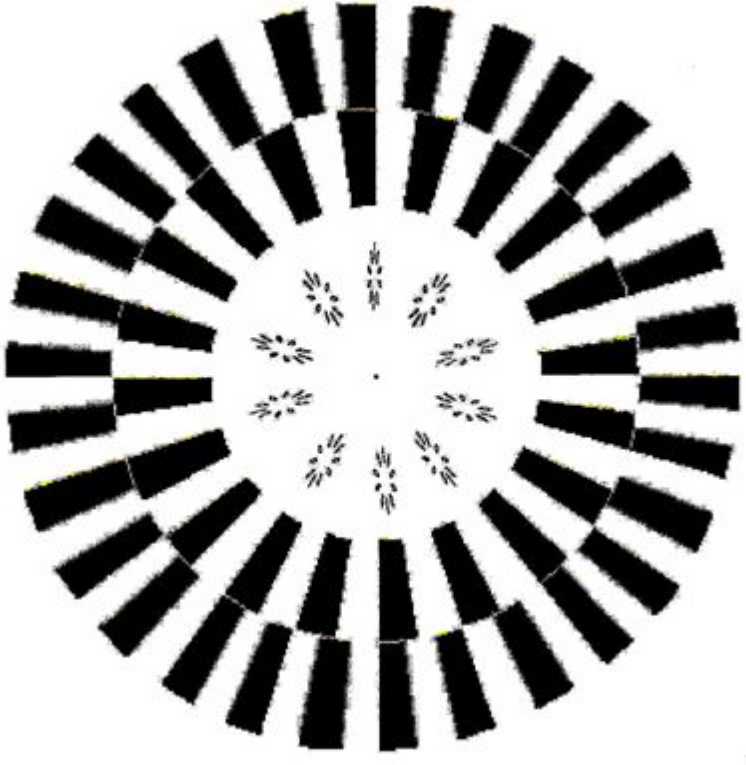




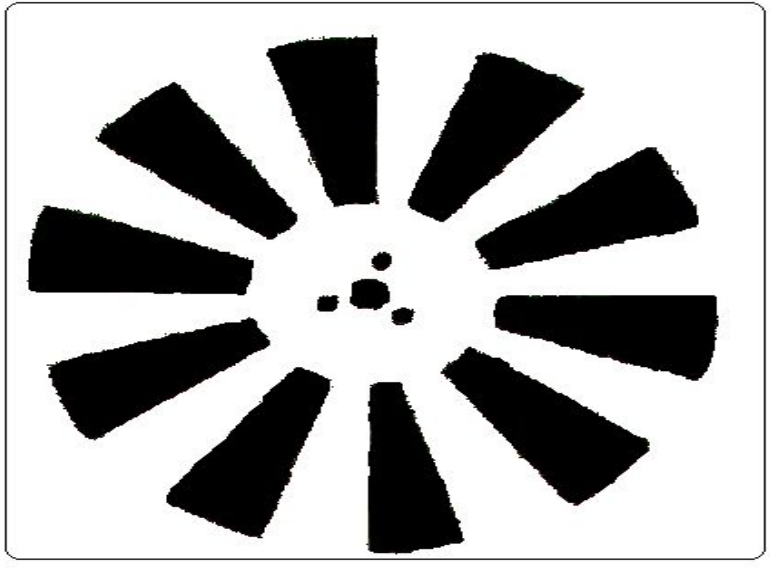
FM Modulator



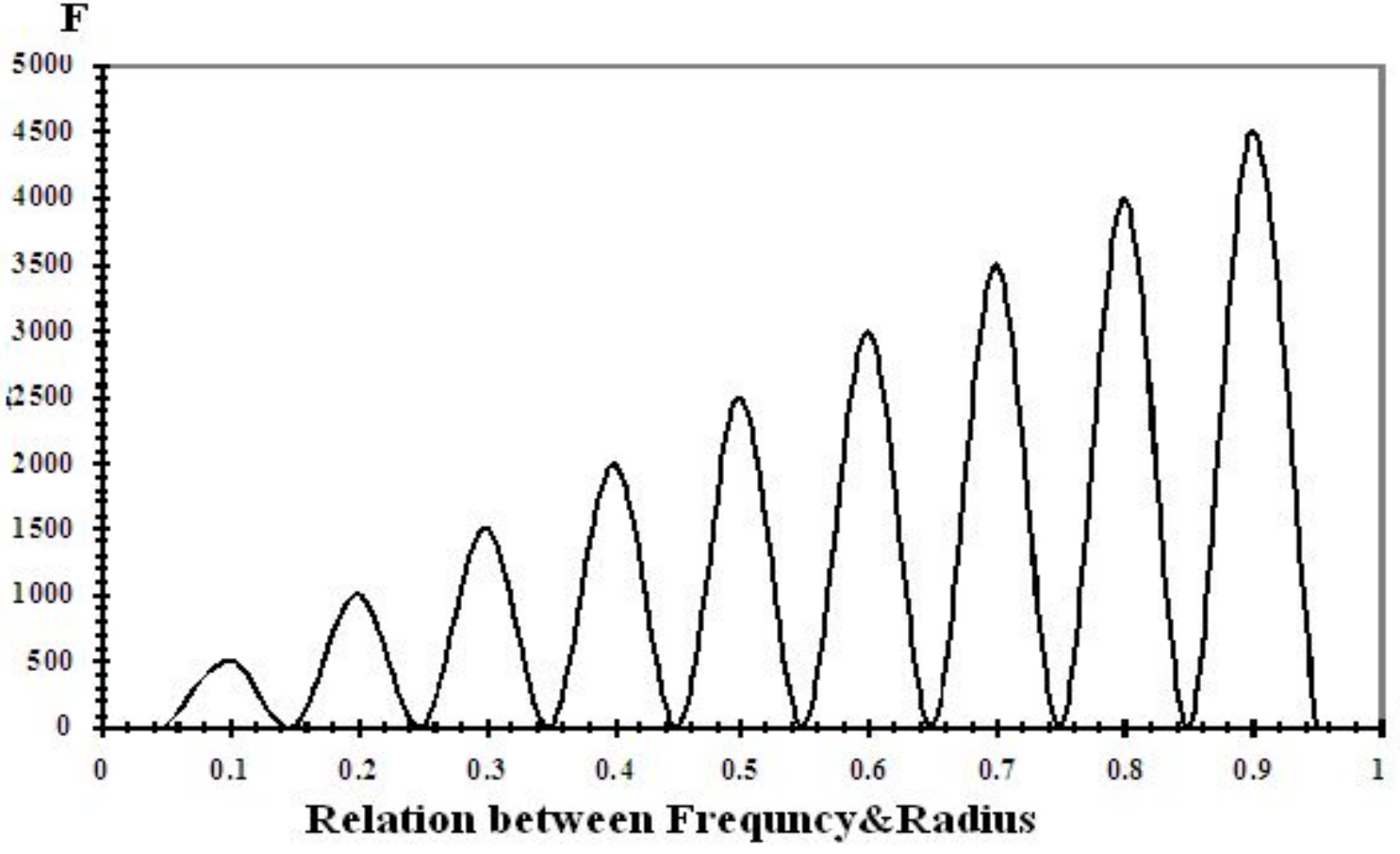

Freactal Modulator

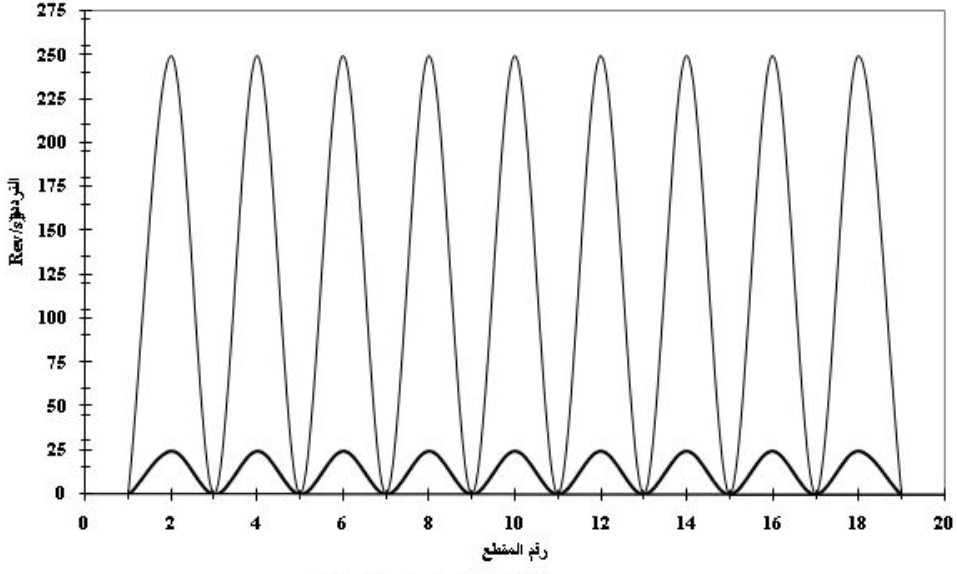


Normal & Fractal Modulator



The output Frequency of The Modu





The Output of AM Frequency

The effecting Factors on the Design

There are many factors affecting on the design of Reticle, which are:

1-The nature of work of electro-optical system (active or passive mode).

2-The type and nature of the objects to be pursued and sources of ambient noise.

3-Determine the dimensions of Reticle.

4-The rotation speed and the number of sectors of Reticle.

5-The requirements of the speed of response of the system.

6-The field of view to be covered. (F O V)

7-The nature of the electronic circuits used in signal processing

In passive mode, the optical modulation disk (Reticle) is used as optical filter for background discrimination. The design and movement of the Reticle is to enhance the object and suppress the background.

To achieve the best efficiency

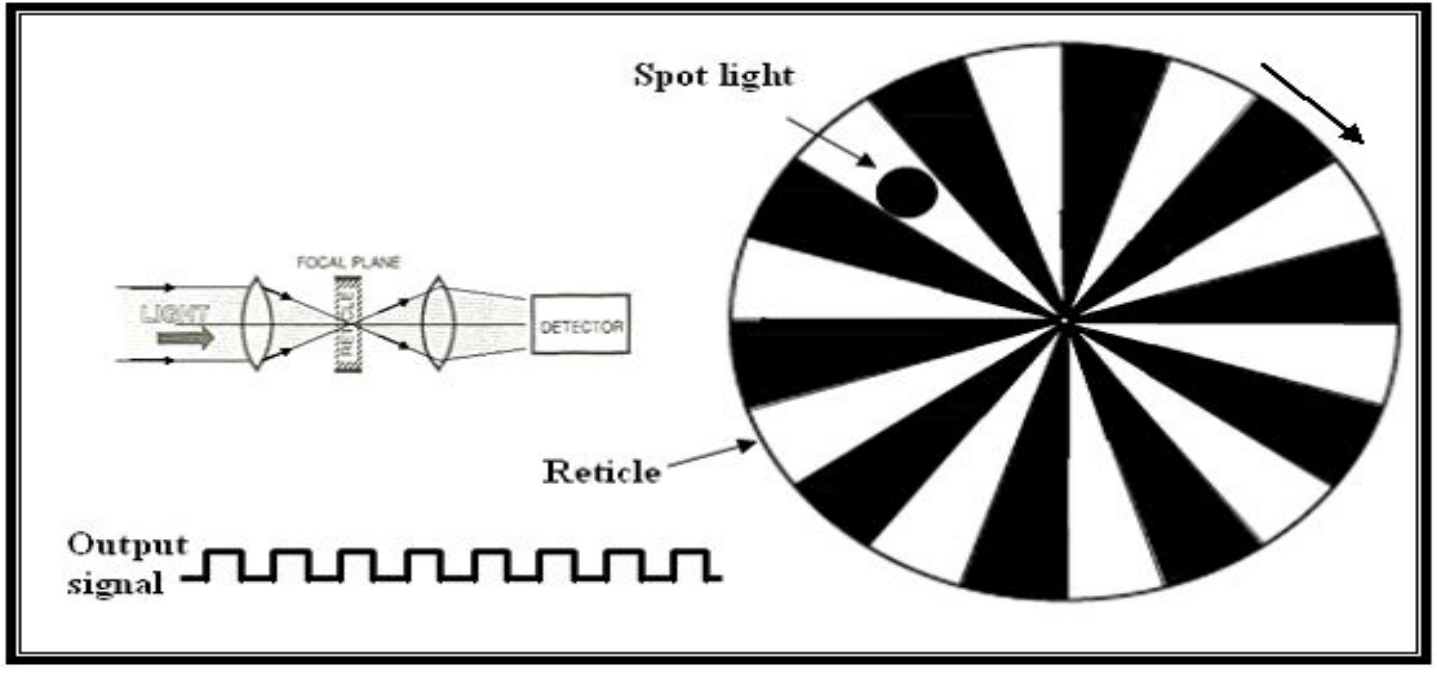
1-To get a best efficiency of the disk in practice must exceed the sector size of Reticle be three times of the spot size of target image.

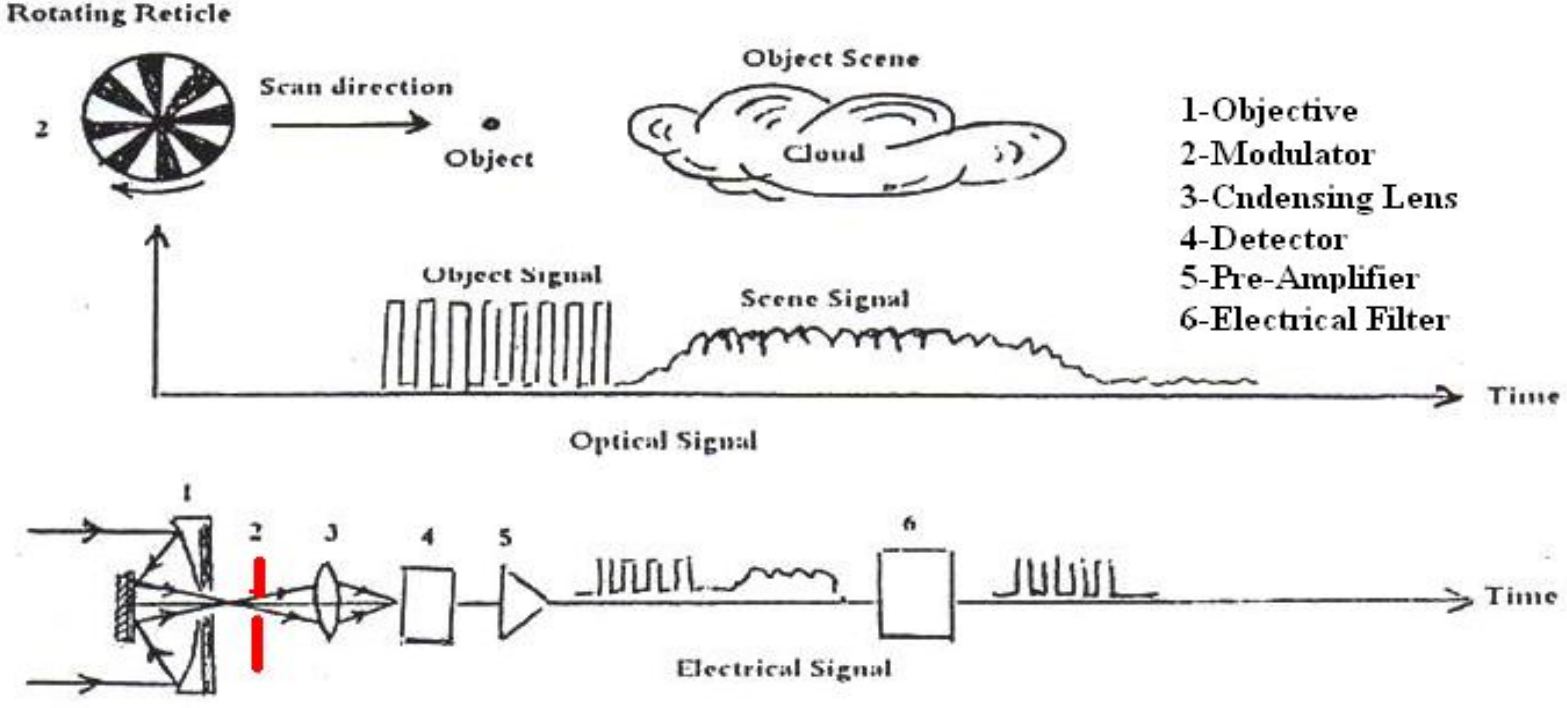
2-Rotate the Optical Spot on the reticle . It will be by :-

a- Rotate the Reticle (modulator) .

OR

b- Rotate the optical System

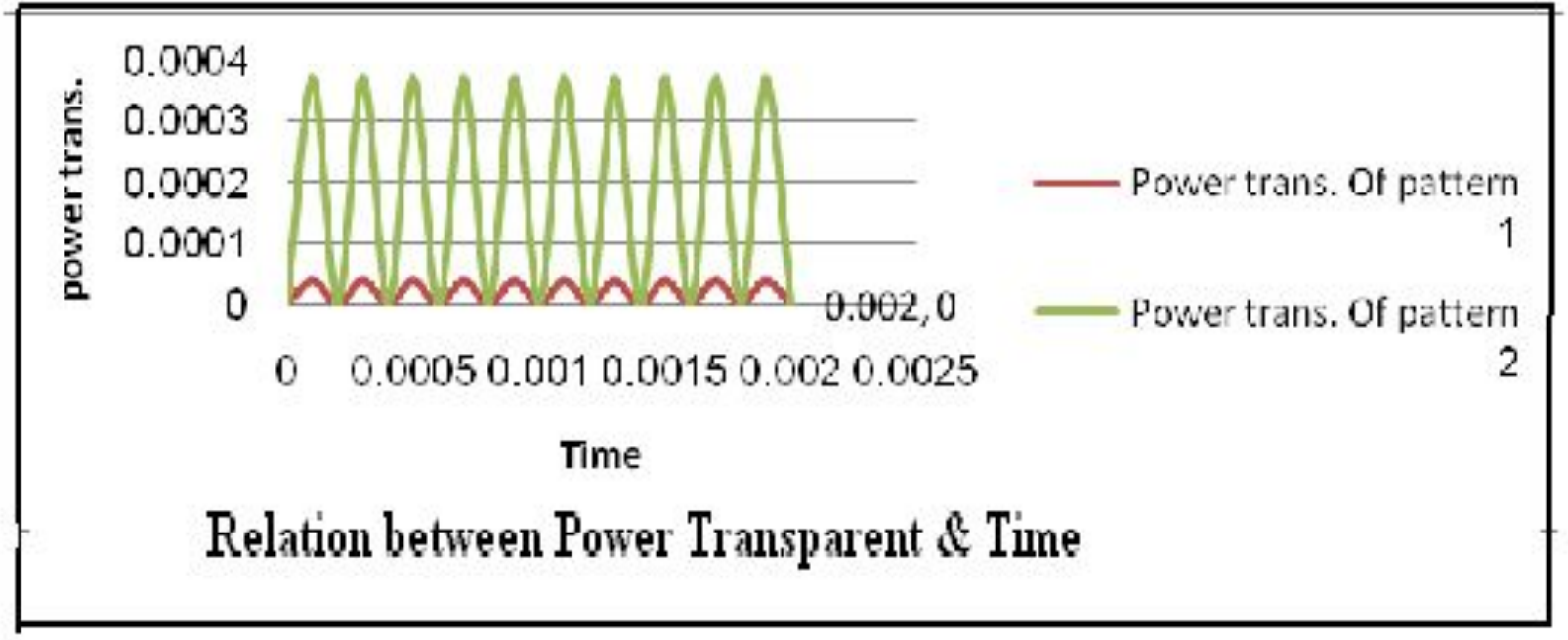

Spot light
FOCAL PLANE
LIGHT
RETICLE
DETECTOR
Reticle
Output
signal



The Function of Modulator

State	Normal Reticle
Radius	0.09 m
Time	0.002 sec
Number of sector	20
spot size of laser	0.5 mm
Angle of sector	18 degree
Circumference	0.5652 m
Area of disk	0.025434 m^2
Area of sub sector	0.0012717 m^2
Angular velocity	1744.44 rad/sec
Rotational frequency	277.77
Chopping frequency	2777.7 rad/sec

Table of Modulator Data



Relation between Power Transparent & Time

To Measure the S / N Ratio for Reticule (Modulator).

S / N = part(1) . Part(2). Part(3). Part(4). Part(5)

$$\frac{S}{N} = \left(\frac{\pi}{4}\right)^{\frac{1}{2}} J(\gamma)$$

$$\left(\frac{J_{atm}(r)}{\Omega'^{2}}\right)$$

$$\left(\frac{D^{*}{}_{BR}\eta_{wr}}{d}\right)$$

$$\left[\left(\frac{1}{BW^{\frac{1}{2}}}\right)K_s\right]$$

$$\left(\frac{D_e}{\theta(FN)}\right)\eta^2{}_c\eta_{cl}m_{is}J_{oe}f.K_{OR}$$

Thank you for your Attention

Any Questions