UM-SJTU JOINT INSTITUTE
Advanced Lasers and Optics Laboratory
(VE438)

Pre Lab Assignment

LAB 6
Acoustic-Optic Modulator

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1 Answers for Pre Lab Questions

1.1 Question 1

AOM is equivalent to a granting with period $d = \lambda_{sound}$, so that the relationship can be expressed as $\lambda_{sound}(\sin\theta \pm \sin i) = m\lambda$ where i is the incident angle and θ is the diffraction angle, m is the order, λ is the wavelength of light and λ_{sound} is the wavelength of sound. According to Bragg condition, we can obtain the biggest diffraction angle with $\sin\theta = m\frac{\lambda}{\lambda_{sound}}$. If we apply the frequency the sound, then the relation becomes $\frac{v_{sound}}{f_{sound}}(\sin\theta \pm \sin i) = m\lambda$, where v_{sound} is the velocity of sound and f_{sound} is sound's frequency.

When the light passes through the sound, its frequency $f' = f_{light} + f_{sound}$, then it's wavelength becomes $\lambda' = \frac{c}{f_{light}+f_{sound}}$

1.2 Question 2

The frequency shift is equal to $m\omega$ where $m = 0, \pm1, \pm2$ and the wavelength becomes $\frac{c\lambda}{c+m\omega\lambda}$, so the coherent length becomes $L = \frac{\lambda^2}{n(\lambda - \frac{c\lambda}{c+m\omega\lambda})}$ where n is the refractive index.