AOTF

AOTF stands for **A**cousto-**O**ptical **T**unable **F**ilter

AOTFs are piezoelectric optical devices, which stress the crystal lattice of an optically transmissive material by ultrasonic energy (usually close to orthogonal to the optical transmission direction with acoustic frequencies in the high MHz domain). One could understand the oscillating lattice as a homogenious density grid with a grid constant given by the sonic velocity c of the material and the acoustic wavelength λs of the ultrasonic signal in this material.

With the light beeing normal to the sound waves, the refractivity n and the wavelength of the light $λl$, the diffraction angle $θ$ is given as

$\sin\theta = \left (\frac{ m\lambda_l}{n\lambda_s} \right)$

where $m = ..., −2, −1, 0, 1, 2, ...$ is the order of diffraction. Diffraction from a sinusoidal modulation in a thin crystal solely results in the $m = −1, 0, +1$ diffraction orders.

Additionally, the amount of light diffracted by the sound wave depends on the intensity of the sound signal. Hence, the intensity of the light in the diffracted beam can be modulated by sound intensity. Typically, the intensity of the m = 1 order can be varied between 0% and 80%.

Beyond that, you could superpose more than one sound signal and produce interferences as standing waves, moirés etc. with very complex optical results. By simply changing the parameters of the (electro-)acoustic signal(s), the characteristics of an AOTF may be changed very quickly over a wide dynamic range.

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