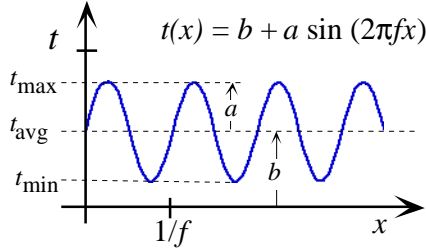


The Diffraction Efficiency of a Sinusoidal Transmission Grating:

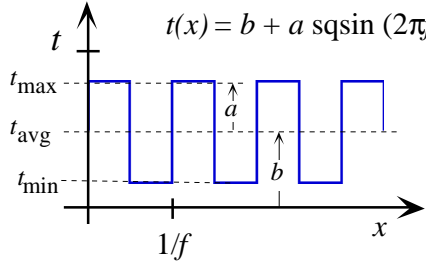


$$DE_0 = b^2$$

$$DE_{+1} = DE_{-1} = \left(\frac{a}{2}\right)^2 \quad DE_{+1, \text{MAX}} = 6.25\%$$

$$DE_{m = \pm 2, \pm 3 \dots} = 0$$

The Diffraction Efficiency of a Square-Wave Transmission Grating:



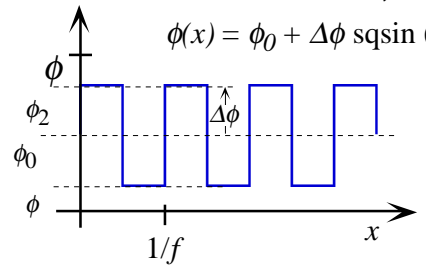
$$DE_0 = b^2$$

$$DE_{+1} = DE_{-1} = \left(\frac{2a}{\pi}\right)^2 \quad DE_{+1, \text{MAX}} = 10.1\%$$

$$DE_{m = \text{even}} = 0 \quad DE_{m = \text{odd}} = \frac{1}{m^2} DE_{+1}$$

$$\sum_{m \neq 0} DE_m = a^2 = 25\%_{\text{max}}$$

The Diffraction Efficiency of a Square-Wave Phase Grating:



$$DE_0 = \cos^2 \Delta\phi$$

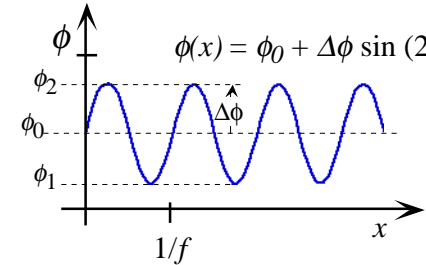
$$DE_{+1} = DE_{-1} = \left(\frac{2}{\pi} \sin \Delta\phi\right)^2 \quad DE_{+1, \text{MAX}} = 40.5\%$$

$$\quad \quad \quad @ \Delta\phi = \pi/2 = 90^\circ$$

$$DE_{m = \text{even}} = 0 \quad DE_{m = \text{odd}} = \frac{1}{m^2} DE_{+1}$$

$$\sum_{m \neq 0} DE_m = \sin^2 \Delta\phi = 100\%_{\text{max}}$$

The Diffraction Efficiency of a Sinusoidal Phase Grating:

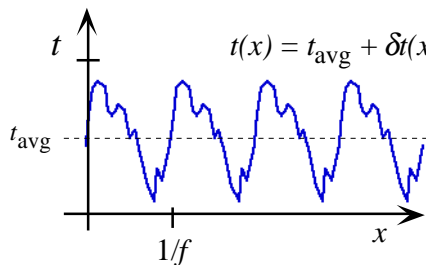


$$DE_0 = J_0^2(\Delta\phi)$$

$$DE_{+1} = DE_{-1} = J_1^2(\Delta\phi) \quad DE_{+1, \text{MAX}} = 33.8\%$$

$$\quad \quad \quad @ \Delta\phi = 1.86 = 0.59\pi = 107^\circ$$

The Diffraction Efficiency of a Generalized (complex transmittance) Grating:



$$DE_0 = |t_{\text{avg}}|^2 \quad DE_{+1, \text{MAX}} = 100\%$$

$$DE_{+1} = \text{power spectrum component}$$

$$\sum_{m \neq 0} DE_m = \overline{|t(x)|^2} - DE_0 = \overline{|\delta t|^2}$$

$$\quad \quad \quad \equiv \text{var } t = \sigma_{\mathcal{L}}$$

note: These all assume that the grating is "optically thin." That is, that $Q = \frac{2\pi \lambda \text{ thickness}}{n d^2 \cos \theta_0} \ll 1$