An approximation of the effect that uneven grating causes in the distribution of the spectrum

Units

$\mu m \equiv mm \cdot 10^{-3}$ $\quad nm \equiv \mu m \cdot 10^{-3}$ $\quad A \equiv m \cdot 10^{-10}$

Iterators $\quad M := 50$

$j := 0 .. M$

diffraction orders $\quad n_1 := 1 \quad n_2 := 2$

grating pitch
Spectrasheen $\quad p := 600 \cdot nm$

light wave lengths
from 400 to 1000 nm

$\lambda := 400$

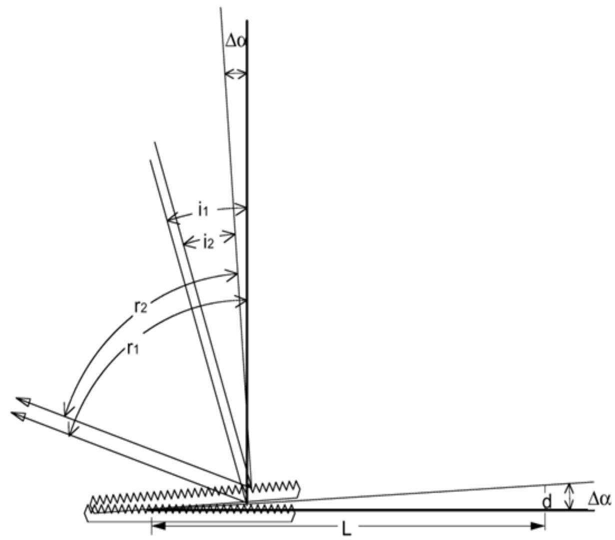
$\lambda_j := ((j \cdot 10) + \lambda) \cdot nm$

Plate glass is flat to 5 wave lengths over 1 inch

$L := 1 \cdot in \quad d := 2.5 \cdot \mu m$

grating rotation caused by
surface uneveness $\quad \Delta\alpha := atan\left(\frac{d}{L}\right)$

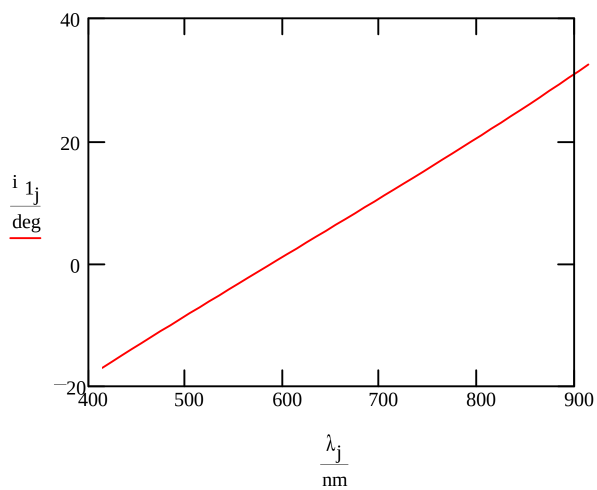
Angle of "grazing incidence"
at the receiver $\quad r_1 := 89.9 \cdot deg$



Illustration

The Diffraction Equation $\quad \sin(i) + \sin(r) = n \cdot \frac{\lambda}{p}$

Star transit angles of incidence
upon the grating $\quad i_{1_j} := asin\left(n_1 \cdot \frac{\lambda_j}{p} - \sin(r_1)\right)$



Altered transit angle caused by grating uneveness

$$i_{2_j} := i_{1_j} - \Delta\alpha$$

Altered receiving angle caused by uneveness

$$r_2 := r_1 - \Delta\alpha$$

$$\sin(i) + \sin(r) = n \cdot \frac{\lambda}{p}$$

The color received as a result of an uneven grating

$$\lambda_{2_j} := \frac{\left(\sin\left(i_{2_j}\right) + \sin\left(r_2\right)\right)}{n_1} \cdot p$$

Color distribution as a result of an uneven grating

$$\Delta\lambda_j := \lambda_j - \lambda_{2_j}$$