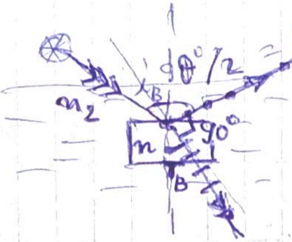
$\dot{I}_1 = \dot{I}_0 \cdot \cos^2\theta$ $\begin{cases} i_B + r_B = 90° \\ n_1 \sin i_B = n_2 \cos r_B \end{cases} \Rightarrow n_1 \sin i_B = n_2 \sin(\pi/2 - i_B)$, $n_1 \sin i_B = n_2 \cos i_B$

deci: $\frac{\sin i_B}{\cos i_B} = \left(\frac{n_2}{n_1}\right) = tg\, i_B$.

3.13/144
$n = 1,9$
$\lambda = 5893 Å$
$i_B = ?$

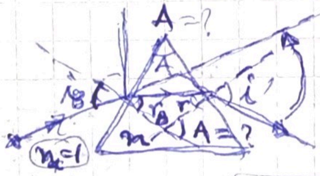
$tg\, i_B = 1,9 = n/1 \Rightarrow i_B \simeq 62°$

3.14
$n = 1,5$
$n_2 =$
$\theta = 97°$
$n_1 = ?$
$i_B = ?$



$tg\, i_B = \left(\frac{n}{n_2}\right) = tg\left(\frac{\theta}{2}\right)$
$\Rightarrow n_2 = n / tg(\theta/2)$

3.15/144
Δ, $n = 1,5 = 3/2$ - sticlă
$i = i' = i_B$
$A = ?$
$\delta_m = ?$



$\delta_m = 2i_B - A$

$tg\, i_B = \left(\frac{n}{n_a}\right) = \frac{n}{1}$
$i_B = arctg\, n$
$tg\, 1,5 \simeq 14,10$

$\delta_m = 2i_B - A$

$\begin{cases} i_B + r_B = \pi/2 \\ i' + r' = \pi/2 \end{cases}$

$A = 2i - 2r = 2(i - r)$
$i_B + r_B = \pi/2 \Rightarrow r_B = \pi/2 - i_B$
$A = 2(i_B - \frac{\pi}{2} + i_B) = 4i_B - \pi$

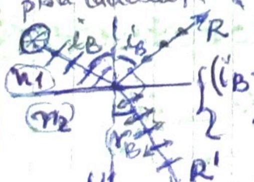
Polarizarea luminii

$\vec{E} \perp \vec{B} \perp \vec{v}$

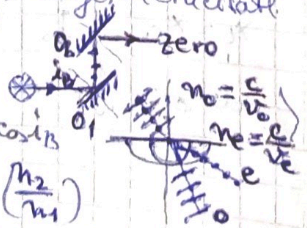
Lumina
a) naturală - nepolarizată (circular)
b) parțial polarizată (eliptic)
c) total polarizată (liniar)

Polarizarea - trecerea luminii din starea naturală/nepolarizată în starea de lumină total polarizată/liniar / circular

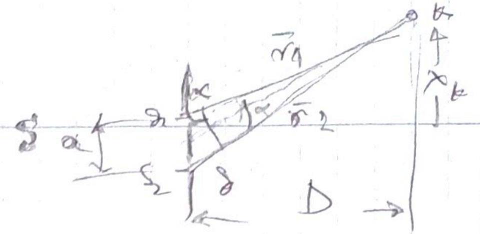
Polarizarea → cu polaroidul (peliculă de polimer care conține o rețea paralelă de celule/molecule liniare)
→ prin reflexie (Aparatul Norremberg) - 2 oglinzi încrucișate
→ prin transmisie repetată
→ prin birefringență



$\begin{cases} (i_B + r_B) = 90° \rightarrow r_B = (\pi/2 - i_B),\ n_1 \sin i_B = n_2 \cos i_B \\ n_1 \sin i_B = n_2 \sin r_B \end{cases}$ $tg\, i_B = \frac{\sin i_B}{\cos i_B} = \left(\frac{n_2}{n_1}\right)$



$\delta = a \sin\alpha$
$tg\,\alpha = x_k / D$



$\sin\alpha \simeq tg\,\alpha \simeq \alpha\ (<5°)$
$\sin\alpha = \frac{\delta}{a} = \frac{x_k}{D} = tg\,\alpha$

$\delta = \left(\frac{a}{D}\right) x_k = \begin{cases} \delta_{max} = (2k)\frac{\lambda}{2} \rightarrow x_k^{max} = (2k)\left(\frac{\lambda}{2}\right)\cdot\frac{D}{a} \\ \delta_{min} = (2k+1)\frac{\lambda}{2} \rightarrow x_k^{min} = (2k+1)\frac{\lambda}{2}\cdot\frac{D}{a} \end{cases}$

$\lambda_0 = cT$
$v = \frac{c}{n}$
$\lambda = v \cdot T = \frac{cT}{n} = \frac{\lambda_0}{n}$

$\lambda_0 = n\lambda$

$i = (x_{k+1} - x_k)$
$i = (2k+2)\frac{\lambda}{2}\frac{D}{a} - 2k\frac{\lambda}{2}\frac{D}{a} =$

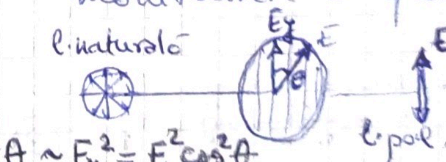
$i = \frac{\lambda D}{a}$ $\begin{cases} i_0 = \frac{\lambda_0 D}{a} \\ i_n = \frac{n\lambda D}{a} \end{cases}$

$\lambda = \frac{a i}{D}$

Aplicații ale polarizării luminii

→ polarizarea rotorie → polarimetre
zaharul { levorotatorie - levogir / dextrotatorie - dextrogir }
→ pelicule polaroide { ochelari de soare, parbrizele și ferestrele mașinilor, fotografia prin vitrine, monitoarele computerelor }

Legea lui Malus



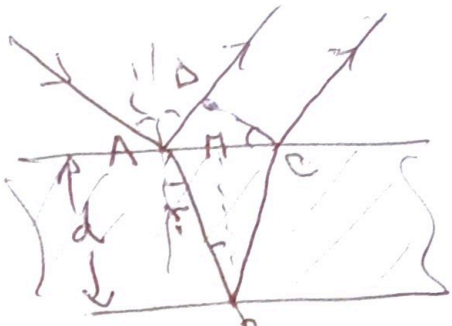
$E_y = E\cos\theta$
$\dot{I}_y \sim E_y^2 \sim E^2\cos^2\theta$
$\dot{I}_y(\theta) = \dot{I}_0 \cos^2\theta$

deci $\dot{I}(\theta) = \dot{I}_M \cos^2\theta \sim E_y^2 = E^2\cos^2\theta$

Polarizarea prin birefringență - constă în divizarea luminii în $CaCO_3$ în două raze { o - raza ordinară / respectă legea refracției ($n_o = \frac{c}{v_o}$); e - raza extraordinară / nu respectă legea refracției ($n_e = \frac{c}{v_e}$) }

Interferența Localizată pe straturi subțiri

Lama cu fețe pl. paralele.



$\delta = (AB+BC)\cdot n - (AD + \lambda/2)$

$\sin i = n \cdot \sin r$

$\cos r = \frac{d}{AB} \rightarrow AB = \frac{d}{\cos r} = AC$

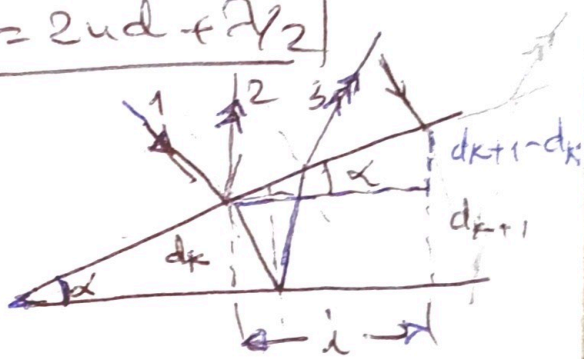
$AD = 2AM = 2d\frac{\sin r}{\cos r}$ $\quad \frac{AM}{MB} = tg\, r = \frac{AM}{d} \rightarrow AM = d\, tg\, r = d\frac{\sin r}{\cos r}$

$\delta = \frac{2nd}{\cos r} - \left(2d\frac{\sin r}{\cos r}\cdot \sin i - \frac{\lambda}{2}\right)$ $\quad \sin i = \frac{AD}{AC} \rightarrow AD = AC \sin i$

$$\boxed{\delta_n = 2nd\cos r + \lambda/2}$$

$i = 0 \rightarrow r = 0 \rightarrow \cos 0 = 1$ $\quad \boxed{\delta_n = 2nd + \lambda/2}$

Pana optică



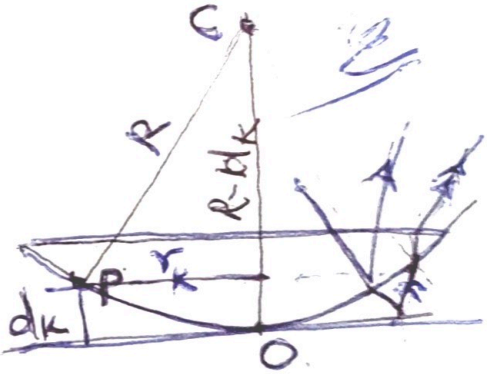
$$\begin{cases} 2nd_k + \lambda/2 = \delta_n = k\lambda \\ 2nd_{k+1} + \lambda/2 = \delta_n = (k+1)\lambda \end{cases}$$

$2n(d_{k+1}-d_k) = \lambda \rightarrow (d_{k+1}-d_k) = \lambda/2n$

dar $tg\,\alpha = \frac{(d_{k+1}-d_k)}{i} \approx \alpha \rightarrow (d_{k+1}-d_k) = \alpha \cdot i$

$\alpha \cdot i = \frac{\lambda}{2n} \rightarrow \boxed{i = \frac{\lambda}{2n\alpha}}$

Inelele lui Newton



$\delta_n = 2nd_k + \lambda/2$

$R^2 = [(R-d_k)^2 + r_k^2] = R^2 - 2Rd_k + d_k^2 + r_k^2$ ($d_k^2 = 0$)

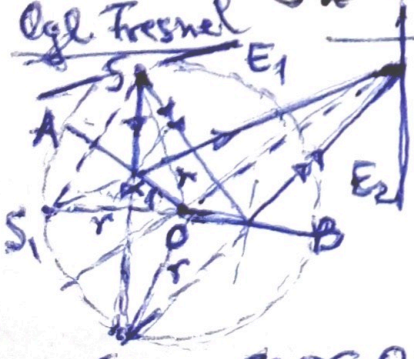
$d_k << R \rightarrow 2Rd_k = r_k^2 \rightarrow \boxed{d_k \approx \frac{r_k^2}{2R}}$

deci $\delta_n = 2n\left(\frac{r_k^2}{2R}\right) + \lambda/2$

$\delta_k^{Max} = (2k)\frac{\lambda}{2} \rightarrow$ Max

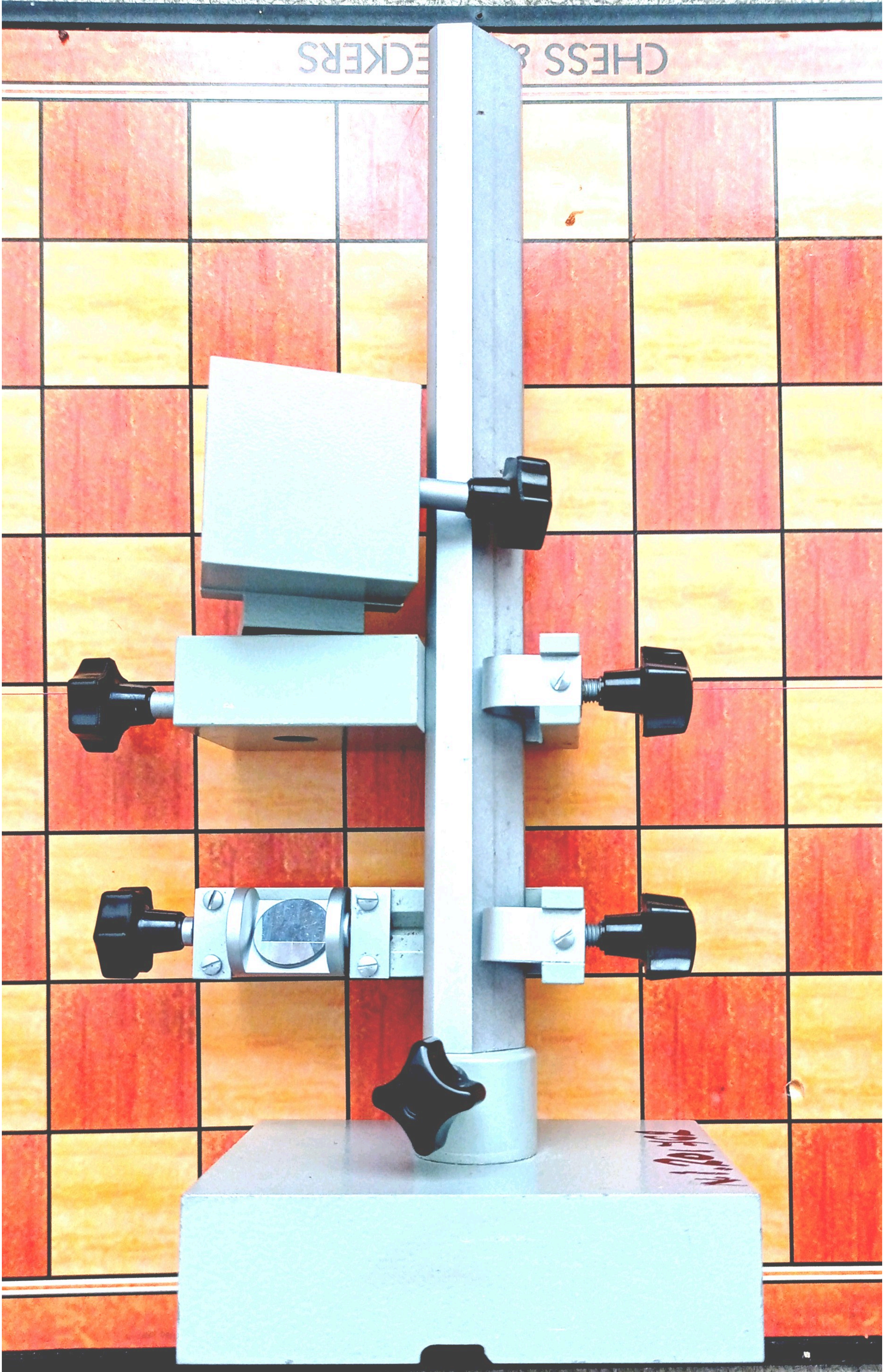
$\delta_k^{min} = (2k+1)\frac{\lambda}{2} \rightarrow$ min

Ogl. Fresnel



$S_0 = S_1O = S_2O = r$

$e = \frac{\lambda}{(k-1)} = \frac{6 \cdot 20 \cdot 10^{-7}}{0,5}$



Pana optica

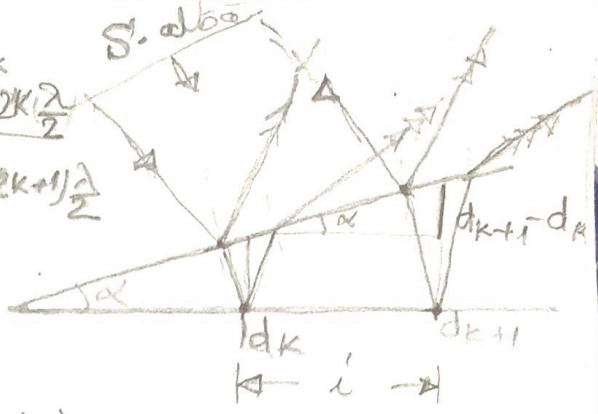
$$\begin{cases} \delta_n^{max} = 2n d_k + \frac{\lambda}{2} = k\lambda = 2k\frac{\lambda}{2} \\ \delta_n^{min} = 2n d_{k+1} + \frac{\lambda}{2} = (k+1)\lambda \end{cases} \quad (\delta_n)$$

$\delta_n^{max} = 2k\frac{\lambda}{2}$

$\delta_n^{min} = (2k+1)\frac{\lambda}{2}$

$$\Rightarrow 2n(d_{k+1} - d_k) = \lambda$$

$$2n\alpha i = \lambda \rightarrow \boxed{i = \frac{\lambda}{2n\alpha}} \quad (*)$$

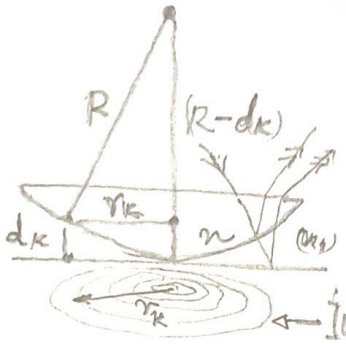


2) Pana optică de unghi α (interferenta localizata)

$$tg\alpha = \frac{(d_{k+1} - d_k)}{i} \simeq \alpha$$

$$\boxed{(d_{k+1} - d_k) \simeq \alpha i} \quad (*)$$

3) Inelele lui Newton



← Inelele lui Newton

$\delta_n = 2n_1(d_k) + \frac{\lambda}{2}$

$$\begin{cases} R^2 = (R-d_k)^2 + r_k^2 \\ R^2 = R^2 - 2Rd_k + d_k^2 + r_k^2 \end{cases}$$

$$\rightarrow \boxed{d_k \simeq \frac{r_k^2}{2R}} \quad x_0$$

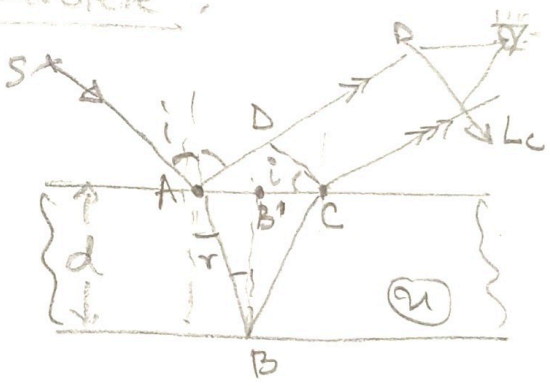
$$\delta_n^{max} = 2n_1 \cdot \frac{r_k^2}{2R} + \frac{\lambda}{2} = n_1\frac{r_k^2}{R} + \frac{\lambda}{2}$$

deci

Max: $\delta_n = n_1\frac{r_k^2}{R} + \frac{\lambda}{2} = (2k)\frac{\lambda}{2}$

min: $\delta_n = n_1\frac{r_k^2}{R} + \frac{\lambda}{2} = (2k+1)\frac{\lambda}{2}$

(1) Straturi subtiri. Lama cu fete plan-paralele.



$$\delta_n = n(AB+BC) - (AD - \frac{\lambda}{2}) = 2n\frac{d}{\cos r} - (\quad)$$

$AB = BC \qquad \sin i = \left(\frac{AD}{AC}\right)$

$AC = 2\cdot AB' = 2d\cdot\frac{\sin r}{\cos r} = 2d\left(\frac{\sin i}{n\cdot\cos r}\right)$

$tgr = \frac{AB'}{BB'} \rightarrow AB' = BB'tgr = d\cdot tgr = d\frac{\sin r}{\cos r}$

$\cos r = \frac{BB'}{AB} \rightarrow AB = \frac{BB'}{\cos r} = \left(\frac{d}{\cos r}\right)$

deci $AD = \frac{2d\sin^2 i}{n\cdot\cos r}$

A: $\sin i = n\cdot\sin r$

$$\begin{cases} \sin i = \left(\frac{AD}{AC}\right) \\ AD = AC\cdot\sin i \end{cases}$$