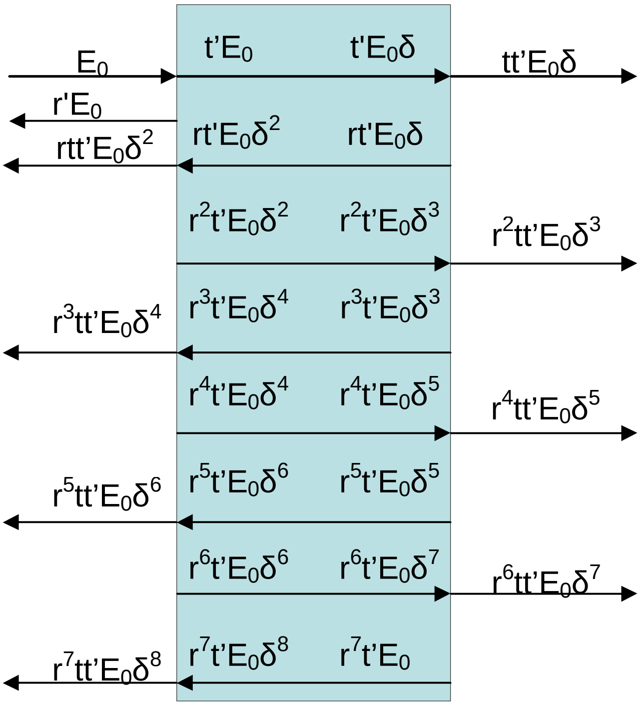
Amplitude reflection/transmission coefficients for normal incidence coming from a medium with n=1 (vacuum), going into a medium with n.



$$r' = \frac{n-1}{n+1}; \qquad t' = \frac{2}{n+1}$$

For the reverse situation:

$$r = \frac{1-n}{n+1} = -r'; \qquad t = \frac{2\cdot n}{n+1} = n\cdot t'$$

For normal incidence we thus have:

$$r + t = 1; \quad r' + t' = 1$$

Further (no absorption): $R = r^2 = r'^2$
and $T = t\cdot t'$; $\quad R + T = 1$.

So for the total amplitude reflection we have
($\delta = \exp(-I\cdot\Delta/2)$, with $\Delta = 2\cdot k\cdot d$ the round trip phase difference, $k = 2\pi/\lambda$, d: thickness of the slab) :

$$r_{fp} = \frac{E_r}{E_0} = -r + t\cdot t'\sum_{k=1}^{\infty} r^{2\cdot k-1}\cdot\delta^{2\cdot k} = \frac{r\cdot\left(r^2\delta^2 - 1 + t\cdot t'\cdot\delta^2\right)}{1-r^2\delta^2} = \frac{r\cdot\left(\delta^2-1\right)}{1-R}\cdot\frac{(1-R)}{1-R\delta^2}$$

For the field in the cavity:

$$w_{fp} = \frac{E_w}{E_0} = t'\cdot\left(\sum_{k=0}^{\infty} r^{2\cdot k}\cdot\delta^{2\cdot k} + \sum_{k=1}^{\infty} r^{2\cdot k-1}\cdot\delta^{2\cdot k}\right) = \frac{t'\cdot\left(1+r\delta^2\right)}{1-r^2\delta^2} = \frac{1}{n}\frac{(1-r)\cdot\left(1+r\cdot\delta^2\right)}{(1-R)}\frac{(1-R)}{1-R\delta^2}$$

For the transmitted field:

$$t_{fp} = \frac{E_t}{E_0} = t\cdot t'\cdot\delta\cdot\left(\sum_{k=0}^{\infty} r^{2\cdot k}\cdot\delta^{2\cdot k}\right) = \frac{t\cdot t'\cdot\delta}{1-r^2\delta^2} = \delta\cdot\frac{1-R}{1-R\delta^2}$$

The intensities are given by:

$$R_{fp} = r_{fp}\cdot r_{fp}^*; \quad W_{fp} = n\cdot w_{fp}\cdot w_{fp}^*; \quad T_{fp} = t_{fp}\cdot t_{fp}^*$$

which can be calculated using: $\delta\cdot\delta^* = 1; \quad \delta^2 + \delta^{*2} = 2\cdot\cos(\Delta) = 2\cdot\left(1 - 2\cdot\sin^2(\Delta/2)\right)$ and defining the coefficient of finesse: $F = \frac{4R}{(1-R)^2}$. The answers are:

$R_{fp} = \frac{F\sin^2(\Delta/2)}{1+F\sin^2(\Delta/2)}; \quad T_{fp} = \frac{1}{1+F\sin^2(\Delta/2)}$, as expected $R_{fp} + T_{fp} = 1$, and

$$W_{fp} = \frac{1 - \frac{4\cdot\sqrt{R}}{1+\sqrt{R}}\sin^2(\Delta/2)}{1+F\sin^2(\Delta/2)}$$