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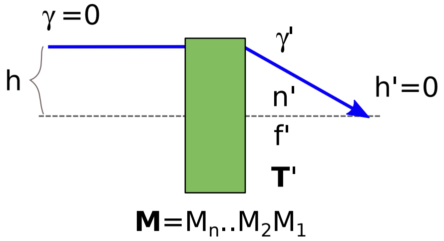
Zobrazení pomocí maticového počtu



fokusace: $$\begin{pmatrix} 0 \\ n'\gamma' \end{pmatrix} = \mathbf{T}'\mathbf{M} \begin{pmatrix} h \\ 0 \end{pmatrix}$$

$$\mathbf{T}'\mathbf{M} = \begin{pmatrix} 1 & \frac{f'}{n'} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} A & B \\ C & D \end{pmatrix} = \begin{pmatrix} A + \frac{f'}{n'}C & B + \frac{f'}{n'}D \\ C & D \end{pmatrix}$$

$$\varphi' \equiv \frac{n'}{f'} = -\frac{C}{A}$$

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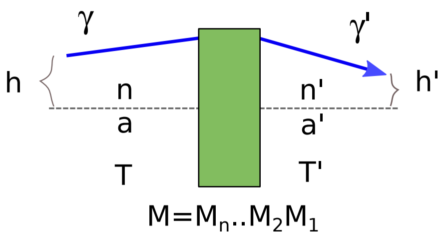

zobrazení: $\begin{pmatrix} h' \\ n'\gamma' \end{pmatrix} = \mathbf{T'MT} \begin{pmatrix} h \\ \gamma \end{pmatrix}$

$$\mathbf{T'MT} = \begin{pmatrix} 1 & \frac{a'}{n'} \\ 0 & 1 \end{pmatrix} \begin{pmatrix} A & B \\ C & D \end{pmatrix} \begin{pmatrix} 1 & \frac{a}{n} \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} A+\frac{a'}{n'}C & \frac{a}{n}\left(A+\frac{a'}{n'}C\right)B+\frac{a'}{n'}D \\ C & C\frac{a}{n}+D \end{pmatrix}$$

h' nezávisí na γ: $\frac{a}{n}\left(A+\frac{a'}{n'}C\right)B+\frac{a'}{n'}D=0$

$$\frac{n'}{f'} = \frac{n}{a}\frac{n'}{a'}\frac{B}{A} + \frac{n}{a}\frac{D}{A} + \frac{n'}{a'}$$

$$\mathbf{T'MT} = \begin{pmatrix} \beta & 0 \\ C & \frac{1}{\beta} \end{pmatrix}$$

$$\beta = A + \frac{a'}{n'}C$$

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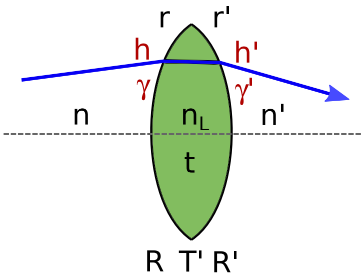

$$\begin{pmatrix} h' \\ n'\gamma' \end{pmatrix} = \mathbf{R}'\,\mathbf{T}\,\mathbf{R}\begin{pmatrix} h \\ n\gamma \end{pmatrix}$$

$$\mathbf{R}' = \begin{pmatrix} 1 & 0 \\ -\varphi' & 1 \end{pmatrix} \qquad \mathbf{T} = \begin{pmatrix} 1 & \frac{t}{n_L} \\ 0 & 1 \end{pmatrix} \qquad \mathbf{R} = \begin{pmatrix} 1 & 0 \\ -\varphi & 1 \end{pmatrix}$$

$$\varphi' = \frac{n' - n_L}{r'} \qquad \varphi = \frac{n_L - n}{r}$$

$$\mathbf{M} = \mathbf{R}'\,\mathbf{T}\,\mathbf{R} = \begin{pmatrix} 1 & 0 \\ -\varphi' & 1 \end{pmatrix}\begin{pmatrix} 1 & \frac{t}{n_L} \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ -\varphi & 1 \end{pmatrix} = \begin{pmatrix} 1 & \frac{t}{n_L} \\ -\varphi' & 1-\varphi'\frac{t}{n_L} \end{pmatrix}\begin{pmatrix} 1 & 0 \\ -\varphi & 1 \end{pmatrix} = \begin{pmatrix} 1-\varphi\frac{t}{n_L} & \frac{t}{n_L} \\ -\varphi'-\varphi+\varphi\varphi'\frac{t}{n_L} & 1-\varphi'\frac{t}{n_L} \end{pmatrix}$$

tenká čočka: $\mathbf{\Phi} = \begin{pmatrix} 1 & 0 \\ -\varphi'-\varphi & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ -\hat{\varphi} & 1 \end{pmatrix}$, $\quad \hat{\varphi} = \varphi' + \varphi - \varphi\varphi'\frac{t}{n_L}$

$$f = n'\left(1 - \varphi\frac{t}{n_L}\right)/\hat{\varphi} = \frac{n'}{\hat{\varphi}} - \frac{n'\varphi t}{n_L\hat{\varphi}}$$

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$$\hat{\varphi} = \varphi' + \varphi - \varphi\varphi' \frac{t}{n_L}, \qquad \varphi' = \frac{n' - n_L}{r'} \qquad \varphi = \frac{n_L - n}{r}$$

čočka ponořená do prostředí: $n{=}n'$

$$\hat{\varphi} = \frac{n - n_L}{r'} + \frac{n_L - n}{r} - \frac{n - n_L}{r'} \frac{n_L - n}{r} \frac{t}{n_L}$$

$$\hat{\varphi} = (n_L - n) \left[-\frac{1}{r'} + \frac{1}{r} + \frac{n_L - n}{rr'} \frac{t}{n_L} \right]$$

tenká čočka ponořená do prostředí:

$$\hat{\varphi} = (n_L - n) \left[\frac{1}{r} - \frac{1}{r'} \right]$$