Module 5:
Example of ABCD matrices

Course 1 of *Optical Engineering*: First Order Optical System Design

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Example: Doublet lens

Using ABCD matrices:

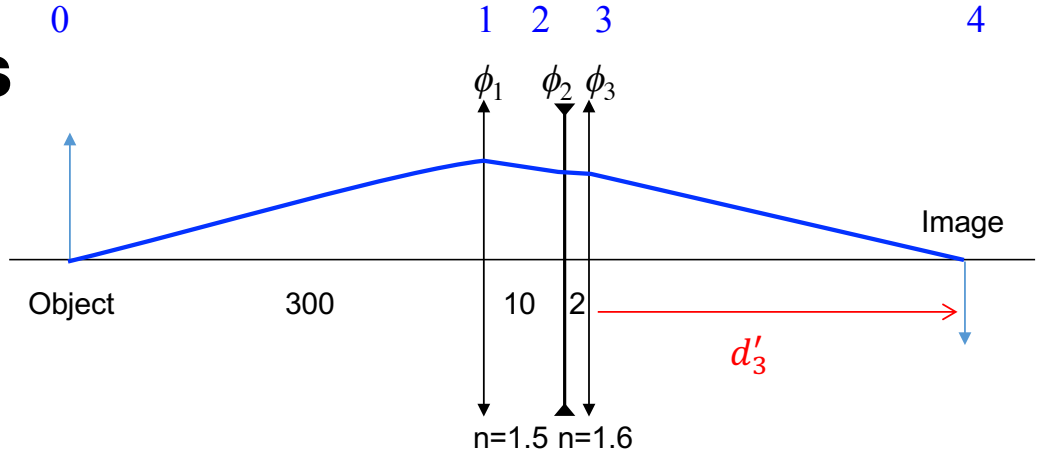
$$\begin{bmatrix} y_4 \\ u'_4 \end{bmatrix} = \mathbf{T}_3\mathbf{R}_3\mathbf{T}_2\mathbf{R}_2\mathbf{T}_1\mathbf{R}_1\mathbf{T}_0 \begin{bmatrix} y_0 \\ u'_0 \end{bmatrix}$$ Note reverse order!

$$\mathbf{T}_k = \begin{bmatrix} 1 & d'_k \\ 0 & 1 \end{bmatrix} \quad \mathbf{R}_k = \begin{bmatrix} 1 & 0 \\ -\phi_k/n'_k & n_k/n'_k \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ u'_4 \end{bmatrix} = \begin{bmatrix} 1 & d'_3 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0 & 1.6 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0.00125 & 0.9375 \end{bmatrix}$$
$$\begin{bmatrix} 1 & 10 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ -0.0067 & 0.667 \end{bmatrix}\begin{bmatrix} 1 & 300 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 0 \\ 0.01 \end{bmatrix}$$

$$= \begin{bmatrix} 2.8488 - 0.01427\, d'_3 \\ -0.01427 \end{bmatrix}$$

$$d'_3 = 199.685 \quad \checkmark$$



Surface k		0	1	2	3	4
Surfaces	c		0.02	-0.02	0	
	n'	1	1.5	1.6	1	
System	$\phi_k = 1/f$		0.01	-0.002	0	
	d'_k	300	10	2	199.7	
Axial ray	y_k	0	3	2.8667	2.8488	0
	u'_k	.01	-.0133	-0.0089	-0.0143	