HEAT TRANSFER

RADIATION – TABLES AND GRAPHS

TABLE 12–1

View factor expressions for some common geometries of finite size (3D)

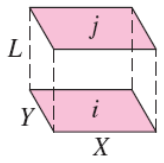
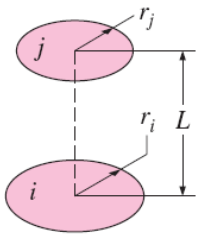
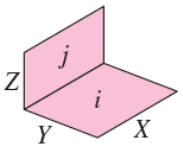
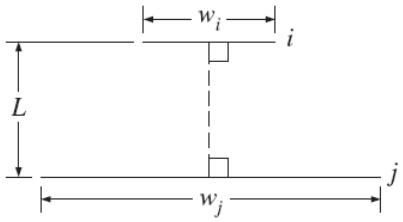
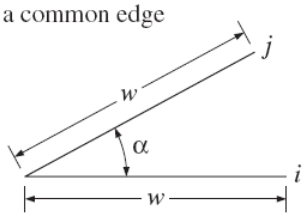
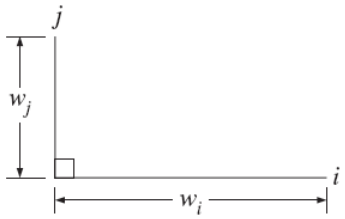
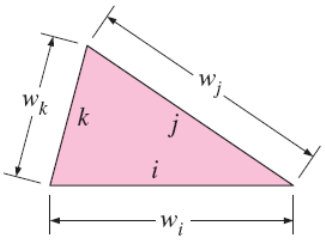
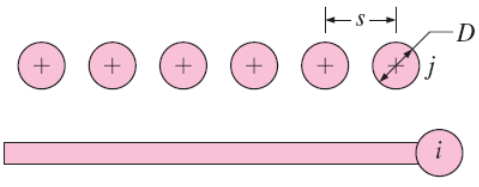
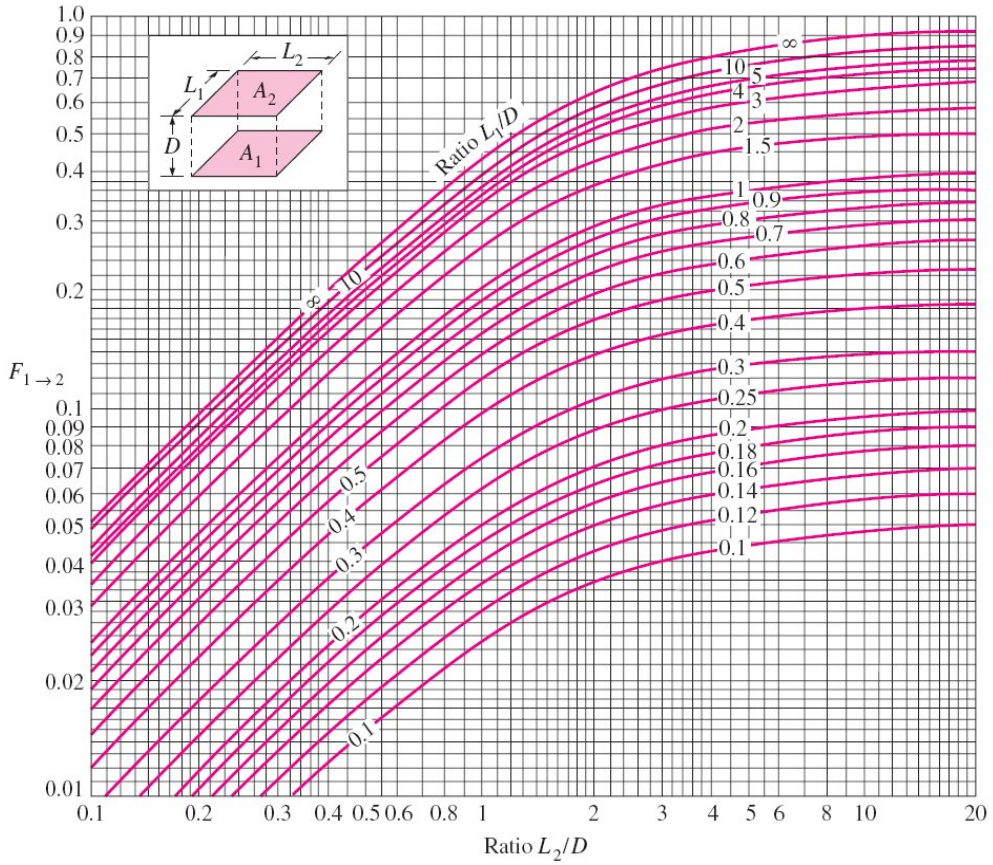
Geometry	Relation
Aligned parallel rectangles 	$\overline{X} = X/L$ and $\overline{Y} = Y/L$ $F_{i\to j} = \frac{2}{\pi \overline{X}\overline{Y}} \left\{ \ln \left[\frac{(1+\overline{X}^2)(1+\overline{Y}^2)}{1+\overline{X}^2+\overline{Y}^2} \right]^{1/2} + \overline{X}(1+\overline{Y}^2)^{1/2} \tan^{-1} \frac{\overline{X}}{(1+\overline{Y}^2)^{1/2}} + \overline{Y}(1+\overline{X}^2)^{1/2} \tan^{-1} \frac{\overline{Y}}{(1+\overline{X}^2)^{1/2}} - \overline{X} \tan^{-1} \overline{X} - \overline{Y} \tan^{-1} \overline{Y} \right\}$
Coaxial parallel disks 	$R_i = r_i/L$ and $R_j = r_j/L$ $S = 1 + \frac{1+R_j^2}{R_i^2}$ $F_{i\to j} = \frac{1}{2} \left\{ S - \left[S^2 - 4 \left(\frac{r_j}{r_i} \right)^2 \right]^{1/2} \right\}$
Perpendicular rectangles with a common edge 	$H = Z/X$ and $W = Y/X$ $F_{i\to j} = \frac{1}{\pi W} \left(W \tan^{-1} \frac{1}{W} + H \tan^{-1} \frac{1}{H} - (H^2+W^2)^{1/2} \tan^{-1} \frac{1}{(H^2+W^2)^{1/2}} + \frac{1}{4} \ln \left\{ \frac{(1+W^2)(1+H^2)}{1+W^2+H^2} \times \left[\frac{W^2(1+W^2+H^2)}{(1+W^2)(W^2+H^2)} \right]^{W^2} \times \left[\frac{H^2(1+H^2+W^2)}{(1+H^2)(H^2+W^2)} \right]^{H^2} \right\} \right)$

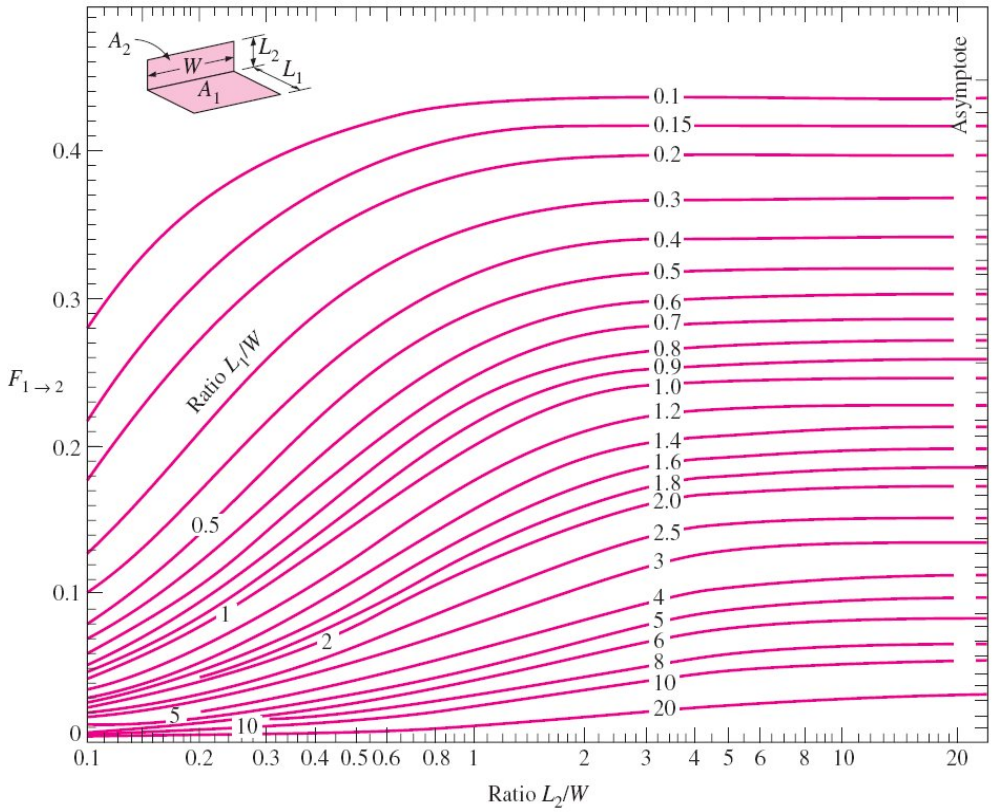
TABLE 12–2

View factor expressions for some infinitely long (2D) geometries

Geometry	Relation
Parallel plates with midlines connected by perpendicular line 	$W_i = w_i/L$ and $W_j = w_j/L$ $$F_{i\to j} = \frac{[(W_i + W_j)^2 + 4]^{1/2} - (W_j - W_i)^2 + 4]^{1/2}}{2W_i}$$
Inclined plates of equal width and with a common edge 	$$F_{i\to j} = 1 - \sin\frac{1}{2}\alpha$$
Perpendicular plates with a common edge 	$$F_{i\to j} = \frac{1}{2}\left\{1 + \frac{w_j}{w_i} - \left[1 + \left(\frac{w_j}{w_i}\right)^2\right]^{1/2}\right\}$$
Three-sided enclosure 	$$F_{i\to j} = \frac{w_i + w_j - w_k}{2w_i}$$
Infinite plane and row of cylinders 	$$F_{i\to j} = 1 - \left[1 - \left(\frac{D}{s}\right)^2\right]^{1/2} + \frac{D}{s}\tan^{-1}\left(\frac{s^2 - D^2}{D^2}\right)^{1/2}$$

View factors for geometries that are infinitely long in the direction perpendicular to the plane of the paper.


L_2
L_1
A_2
D
A_1
Ratio L_1/D
∞
10
5
4
3
2
1.5
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.25
0.2
0.18
0.16
0.14
0.12
0.1
$F_{1\to 2}$
Ratio L_2/D


A_2
W
L_2
L_1
A_1
Asymptote
Ratio L_1/W
0.1
0.15
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.2
1.4
1.6
1.8
2.0
2.5
3
4
5
6
8
10
20
$F_{1\to 2}$
Ratio L_2/W

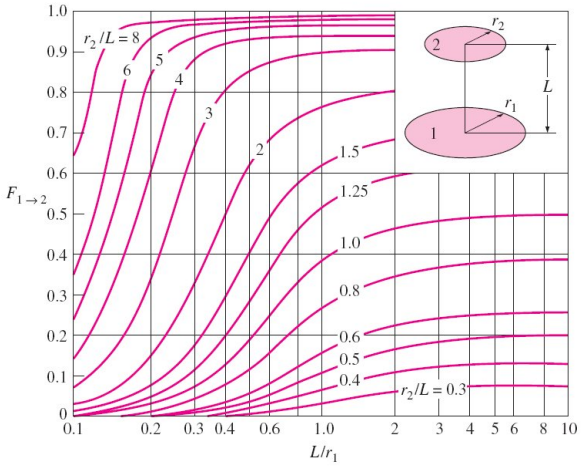


FIGURE 12–7
View factor between two coaxial parallel disks.

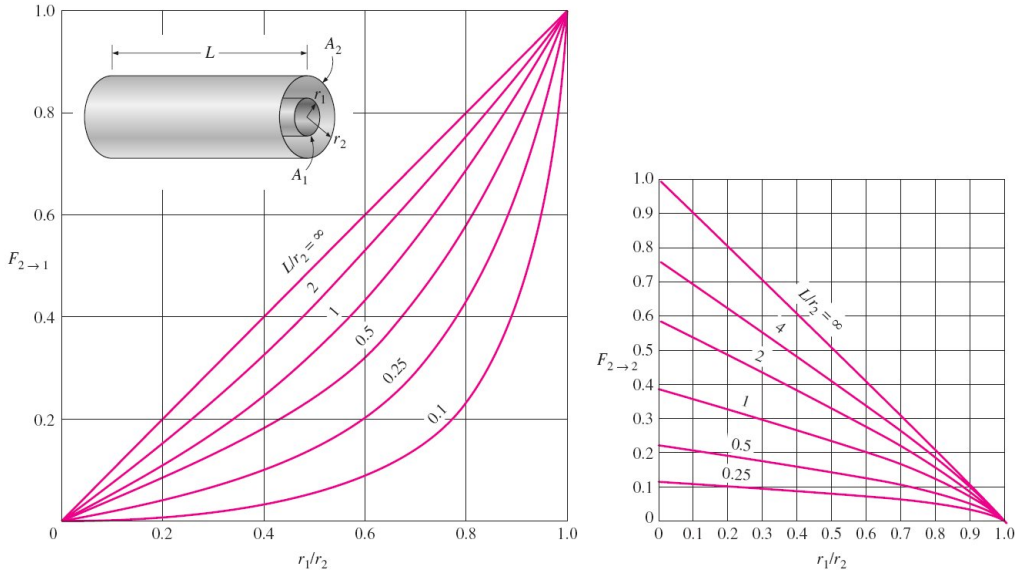


FIGURE 12–8
View factors for two concentric cylinders of finite length: (*a*) outer cylinder to inner cylinder; (*b*) outer cylinder to itself.