

APPENDIX B

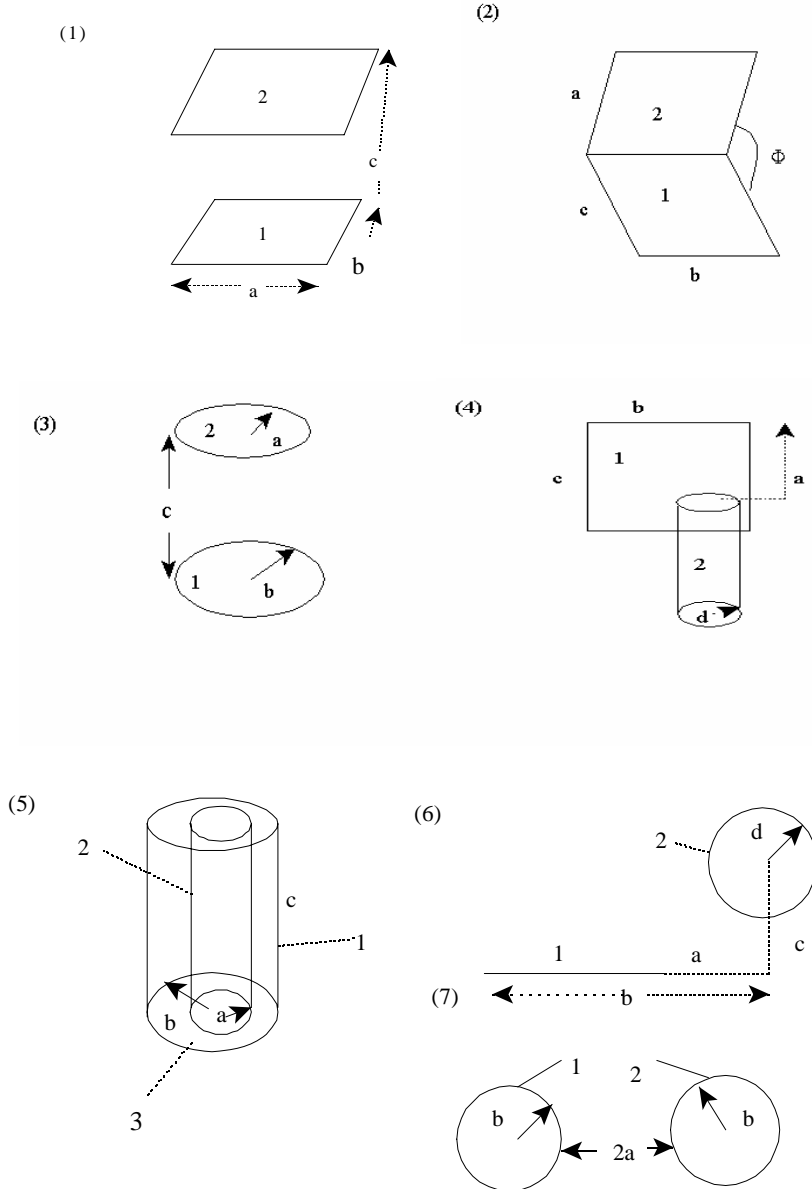


Figure B.1. Schematic representation of configuration 1–7

B.1 Configuration Factor for Some Common Surfaces

Configuration 1: $X = a/c, Y = b/c$

$$F_{A_1 \rightarrow A_2} = \frac{2}{\pi XY} \left\{ \ln \left[\frac{(1+x^2)(1+Y^2)}{1+X^2+Y^2} \right] \right\}^{1/2} + X\sqrt{1+Y^2} \tan^{-1} \frac{X}{\sqrt{1+Y^2}} \\ + Y\sqrt{1+X^2} \tan^{-1} \frac{Y}{\sqrt{1+Y^2}} - X \tan^{-1} X - Y \tan^{-1} Y$$

Configuration 2: $X = a/b, Y = c/b, Z = X^2 + Y^2 - 2XY \cos \phi$

$$(\pi Y) F_{A_1 \rightarrow A_2} = -\frac{\sin 2\phi}{4} \left[XY \sin \phi + \left(\frac{\pi}{2} - \phi \right) (X^2 + Y^2) \right. \\ \left. \times Y^2 \tan^{-1} \left(\frac{X - Y \cos \phi}{Y \sin \phi} \right) + X^2 \tan^{-1} \left(\frac{Y - X \cos \phi}{X \sin \phi} \right) \right] \\ + \frac{\sin^2 \phi}{4} \left(\frac{2}{\sin^2 \phi} - 1 \right) \ln \left[\frac{(1+X^2)(1+Y^2)}{1+Z} \right] \\ + Y^2 \ln \left[\frac{Y^2(1+Z)}{(1+Y^2)Z} \right] + X^2 \ln \left[\frac{X^2(1+Z)^{\cos \phi}}{Z(1+Z)^{\cos 2\phi}} \right] \\ \times Y \tan^{-1} \frac{1}{Y} + X \tan^{-1} \frac{1}{X} - \sqrt{Z} \tan^{-1} \left(\frac{1}{\sqrt{Z}} \right) \\ + \frac{1}{2} \sin \phi \sin 2\phi X \sqrt{1+X^2 \sin^2 \phi} \\ \times \left[\tan^{-1} \left(\frac{X \cos \phi}{\sqrt{1+X^2 \sin^2 \phi}} \right) + \tan^{-1} \left(\frac{Y - X \cos \phi}{\sqrt{1+X^2 \sin^2 \phi}} \right) \right] \\ + \cos \phi \times \int_0^Y \sqrt{1+\zeta^2 \sin^2 \phi} \left[\tan^{-1} \left(\frac{X - \zeta \cos \phi}{\sqrt{1+\zeta^2 \sin^2 \phi}} \right) + \tan^{-1} \left(\frac{\zeta \cos \phi}{\sqrt{1+\zeta^2 \sin^2 \phi}} \right) \right] d\zeta$$

Configuration 3: $X = a/c, Y = c/b, Z = 1 + (1 + X^2)Y^2$

$$F_{A_1 \rightarrow A_2} = \frac{1}{2} \left(Z - \sqrt{Z^2 - 4X^2 Y^2} \right)$$

Configuration 4 : $X = a/d, Y = b/d, Z = c/d$

$$A = Z^2 + X^2 + \zeta^2 - 1, B = Z^2 - X^2 - \zeta^2 + 1$$

$$F_{A_1 \rightarrow A_2} = \frac{2}{y} \int_0^{y/2} f(\zeta) d\zeta$$

where

$$f(\zeta) = \frac{X}{X^2 + \zeta^2} = \frac{X}{\pi(X^2 + \zeta^2)} \\ \times \left\{ \cos^{-1} \frac{B}{A} - \frac{1}{32} \left[\sqrt{A^2 + 4Z^2} \cos^{-1} \left(\frac{B}{A\sqrt{X^2 + \zeta^2}} \right) \right. \right. \\ \left. \left. + B \sin^{-1} \left(\frac{1}{\sqrt{X^2 + \zeta^2}} \right) - \frac{\pi A}{2} \right] \right\}$$

Configuration 5: $X = b/c$, $Y = c/a$

$$A = Y^2 + X^2 - 1, B = Y^2 - X^2 + 1$$

$$F_{A_1 \rightarrow A_2} = \frac{1}{X} - \frac{1}{\pi X} \left(\cos^{-1} \frac{B}{A} - \frac{1}{2Y} \right) \sqrt{(A+2)^2 - 4X^2} \cos^{-1} \frac{B}{XA} \\ + B \sin^{-1} \frac{1}{X} - \frac{\pi A}{2}$$

$$F_{A_1 \rightarrow A_1} = 1 - \frac{1}{X} + \frac{2}{\pi X} \tan^{-1} \left(\frac{2\sqrt{X^2 - 1}}{Y} \right) - \frac{Y}{2\pi X} \left(\frac{\sqrt{4X^2 + Y^2}}{Y} \right) \\ \times \sin^{-1} \left[\frac{4(X^2 - 1) + \frac{Y^2}{X^2}(X^2 - 2)}{Y^2 + 4(X^2 - 1)} \right] - \sin^{-1} \frac{(X^2 - 2)}{X^2} \\ + \frac{\pi}{2} \left(\frac{\sqrt{4X^2 + Y^2}}{Y} - 1 \right)$$

Configuration 6: $X = c/d$, $Y = a/d$, $Z = b/d$

$$F_{A_1 \rightarrow A_2} = \frac{1}{Z - Y} \left(\tan^{-1} \frac{Z}{X} - \tan^{-1} \frac{Y}{X} \right)$$

Configuration 7: $X = 1 + a/b$

$$F_{A_1 \rightarrow A_2} = \frac{2}{\pi} \left(\sqrt{X^2 - 1} - X + \frac{\pi}{2} - \cos^{-1} \frac{1}{X} \right)$$