Week 13

Lecture 1

Last lecture of the term.

Discuss application of "crossed-string method" to system consisting of one concave surface and one convex surface.

Radiative network for an enclosure with three diffuse gray isothermal surfaces: surface A_1, ϵ_1, T_1, surface A_2, ϵ_2, T_2, surface A_R, ϵ_R, T_R, where $T_1 > T_R > T_2$; surface A_R is a refractory surface (it is a zero flux surface) with $J_R = E_{bR} = \sigma T_R^4$; show radiative nodes: $E_{b1}, E_{b2}, E_{bR}, J_1, J_2, J_R$, radiative resistors: $R_{s1}, R_{s2}, R_{sR}, R_{12}, R_{1R}, R_{R2}$, and the equivalent radiative resistor for the network (see Fig. 13.13 in the text):

$$R_{\text{eq}} = R_{s1} + \left[\frac{1}{R_{12}} + \frac{1}{R_{1R} + R_{R2}}\right]^{-1} + R_{s2}$$

show $Q_1, Q_2, Q_R = 0$, and net radiative exchange between surfaces A_1 and A_2 where (see Eq. 13.30):

$$Q_{12} = \frac{(E_{b1} - E_{b2})}{R_{\text{eq}}}$$

give examples. See Maple worksheets on the Web:

EXP13P5.MWS and EXP13P6.MWS for examples from Chapter 13.

Temperature of refractory surface obtained from $T_R = (J_R/\sigma)^{1/4}$ where the refractory radiosity is found from:

$$J_R = \frac{J_1 R_{R2} + J_2 R_{1R}}{R_{1R} + R_{R2}}$$

Also the radiosities J_1, J_2 are obtained from $J_1 = E_{b1} - Q_{12} R_{s1}$ and $J_2 = E_{b2} + Q_{12} R_{s2}$.

Final examination: closed book, two crib sheets (both sides), calculator is allowed; five questions of equal value; conduction, convection and radiation topics are covered; some questions may combine conduction, convection and radiation topics. See Web site and Engineering Photcopy Center for copy of Final Examination, Fall 1996 with solutions. Monday, December 8, 2:00-5:00 P.M.