CH EN 3453 – Heat Transfer

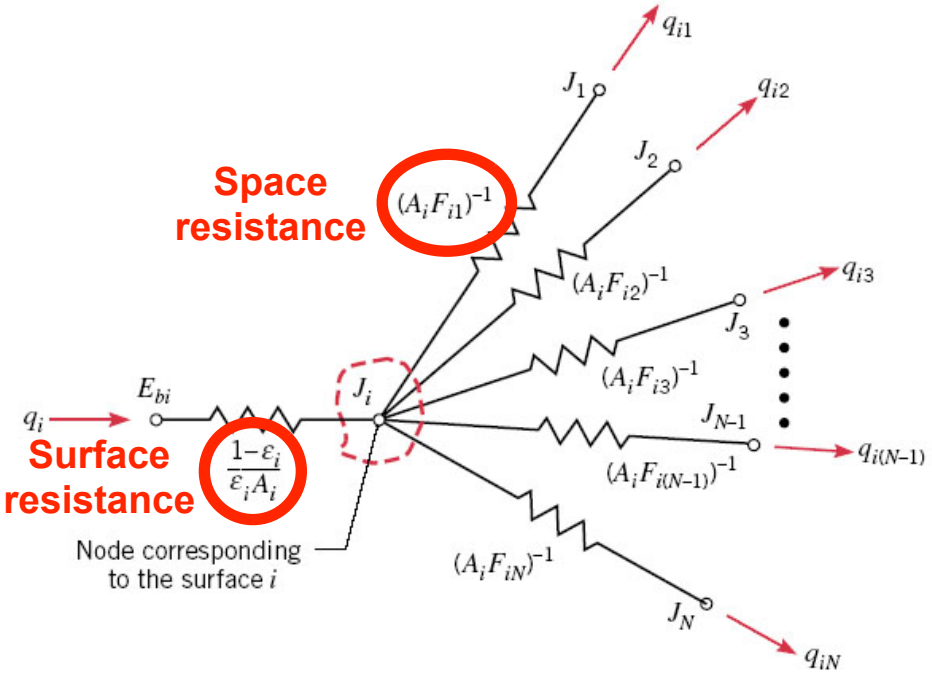
Radiation: Network Representations Continued

Sections 13.2 to 13.3

Reminders…

- Report Peer Reviews due **Today** by 8:00 PM
  - Email marked-up Word document directly to students, with a copy to report@chen3453.com
- Final Heat Exchanger report due Wednesday next week
  - Review peer reviews and grading rubric
  - Email PDF version to report@chen3453.com by 8:00 pm
  - 25% loss for every day late
  - Do not bring to class, slip under my door or send by email
  - Remember to check web resources (writing, grading rubric, etc.)
- Homework #12 due Monday next week
  - Help session Wednesday at 4:30 pm in MEB 2325 (Bethany teaches)
- Final exam Wednesday, December 17
  - This room
  - 8:00 to 10:00 a.m.
- Cody teaches Friday – Gas Radiation

Review: Radiation between Surfaces

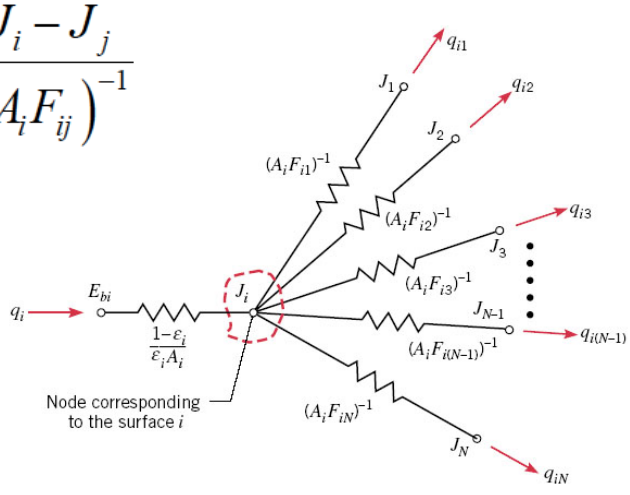


"Direct Method" for Solving Networks

- Useful for systems with >2 surfaces
- Balance radiant energy around each surface node *i* :

$$\frac{E_{bi}-J_i}{(1-\varepsilon_i)/\varepsilon_i A_i}=\sum_{j=1}^{N}\frac{J_i-J_j}{\left(A_iF_{ij}\right)^{-1}}$$

- Solve system of equations



Multimode Heat Transfer

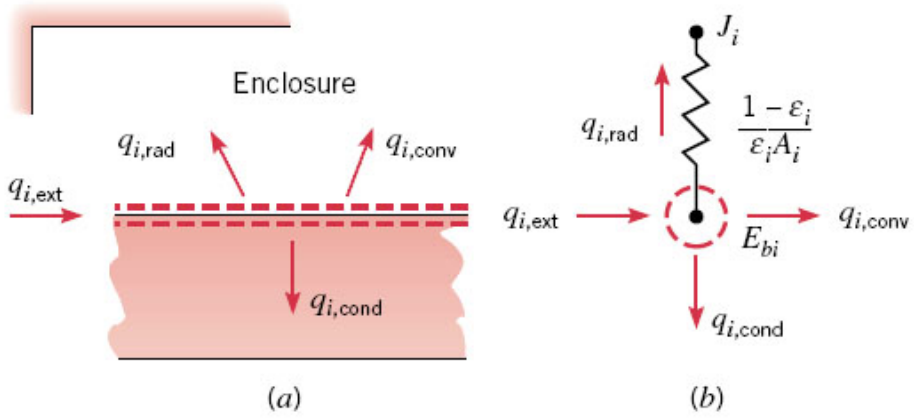
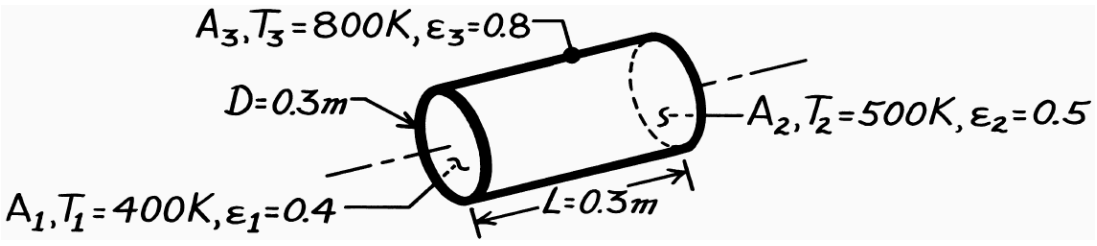


FIGURE 13.13 Multimode heat transfer from a surface in an enclosure. (*a*) Surface energy balance. (*b*) Circuit representation.

Example: Problem 13.83

Consider a circular furnace that is 0.3 m long and 0.3 m in diameter. The two ends have diffuse, gray surfaces that are maintained at 400 and 500 K, with emissivities of 0.4 and 0.5, respectively. The lateral surface is also gray with an emissivity of 0.8 and a temperature of 800 K. Determine the net radiative heat transfer from each of the surfaces.



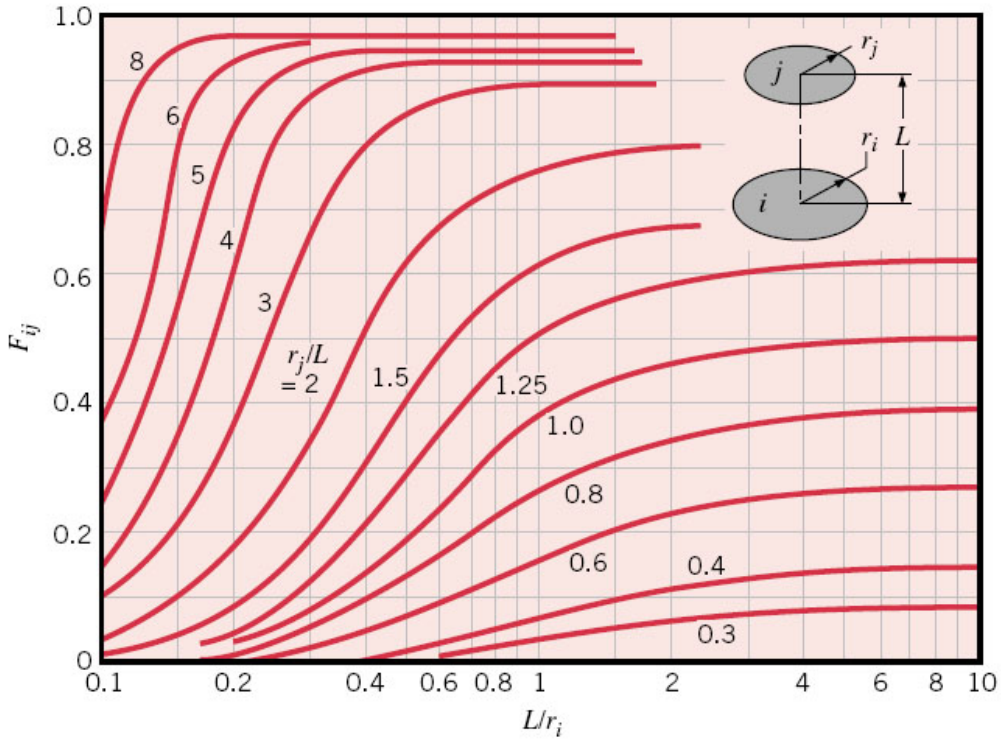


FIGURE 13.5 View factor for coaxial parallel disks.