Cankaya University
Faculty of Engineering
Mechanical engineering Department
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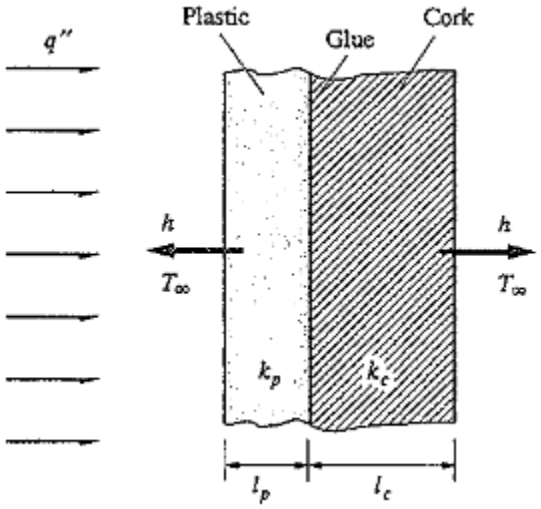
HW #1

1)

In a manufacturing operation, a sheet of plastic 1 cm thick is to be glued to a sheet of cork board 3 cm thick To affect a bond, the glue is to be maintained at a temperature of 30 °C for a considerable period of time. This is accomplished by a source of radiant heat, applied uniformly over the surface of the plastic. The exposed sides of the cork and the plastic have a heat transfer coefficient by convection of 10 $W/m^2 \cdot K$, and the room temperature during the operation is 25 °C. Estimate the rate at which heat must be supplied to the surface of the plastic to obtain the required temperature at the interface. The thermal resistance of the glue may be neglected. The thermal conductivities of plastic and of cork are 2.3 and 0.042 $W/m \cdot K$, respectively. Draw the thermal circuit for the system.



2)

Neglecting the effect of curvature, assume that an industrial brake system may be simulated by a flat plate (brake drum) moving on a composite plate (brake shoe) with a constant velocity V (Fig. 2P–3). The constant and uniform interface pressure is p. The coefficient of dry friction is μ, the ambient temperature is T_∞, and the heat transfer coefficients are h_1, h_2. The thermal conductivities and the thicknesses of the plates are k_1, k_2, and ℓ_1, ℓ_2, respectively. **(a)** Find the heat transfer to the drum and to the shoe. **(b)** Find the maximum temperature of the brake. **(c)** Draw the analogous electrical circuit for part (a).

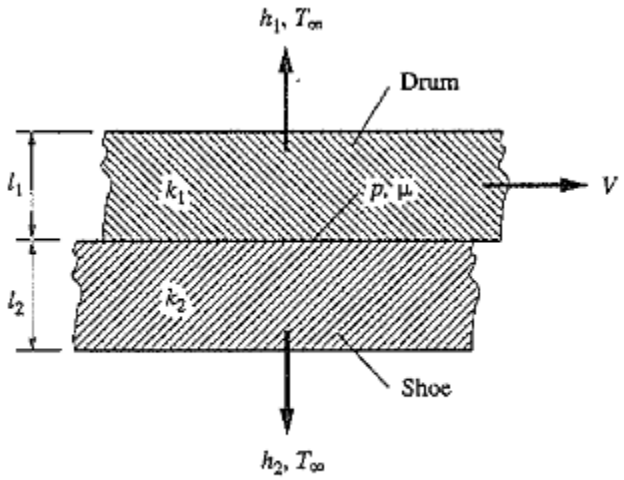


Figure 2P–3

3)

Consider an infinitely long fin. Internal energy u''' is steadily generated in a part of the fin 2ℓ long (Fig. 2P–10). The entire fin transfers heat with a coefficient h to an ambient at temperature T_∞. **(a)** Find the temperature distribution within the fin. **(b)** Resolve the problem for a fin $2(\ell + L)$ long with insulated ends. The internal energy continues to be generated in the 2ℓ long central part of the fin.

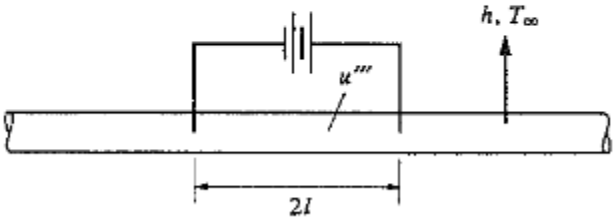


Figure 2P–10

4) *A conical spine with a base radius R and length L exchanges heat with the ambient by convection. The heat transfer coefficient is h and the ambient temperature is T_∞. The base is maintained at T_o. Using a fin model, determine the steady state heat transfer rate.*