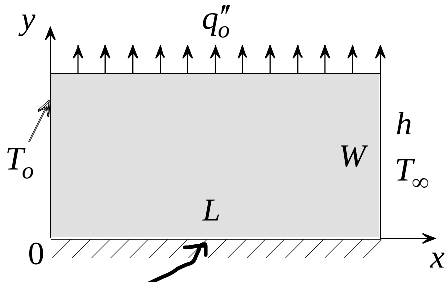
Cankaya University
Faculty of Engineering
Mechanical Engineering Department
ME 611 Advanced Conduction Heat Transfer
HW # 2

P 2.4 of Text Book
P 2.5 of Text Book

P.3) Consider the geometry given below. For steady state two-dimensional conduction in the rectangular plate shown.

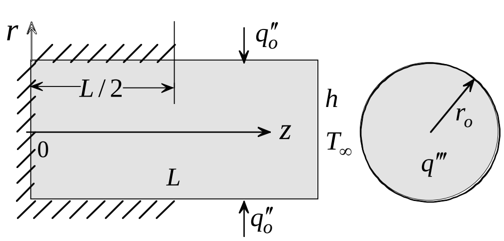


Governing equation is

$$\frac{\partial^2 T}{\partial x^2}+\frac{\partial^2 T}{\partial y^2}=0$$

Write the boundary conditions for steady state two-dimensional conduction in the rectangular plate shown.

P-4) Heat is generated at a volumetric rate q''' in a rod of radius r_o and length L. Half the cylindrical surface is insulated while the other half is heated at a flux q_o''. One end is insulated

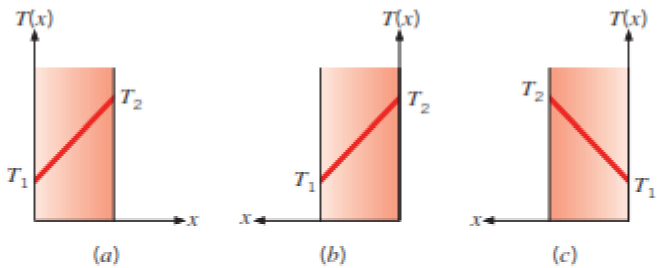


and the other exchanges heat by convection. Governing equation is

$$\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial T}{\partial r}\right)+\frac{\partial^2 T}{\partial z^2}+\frac{q'''}{k}=0$$

Write the boundary conditions for steady state two-dimensional conduction

P-5) Consider a plane wall 120mm thick and of thermal conductivity 120W/m.K. Steady-state conditions are known to exist with T_1= 500 K and T_2= 700 K. Determine the heat flux q''_x and the temperature gradient dT/dx for the coordinate systems shown.



P-6) The temperature distribution across a wall 0.3 m thick at a certain instant of time is $T(x)=a+bx + cx^2$, where T is in degrees Celsius and x is in meters, a=200 0C, b =-200 ^{0}C/m, and c= 30 ^{0}C/m^2. The wall has a thermal conductivity of 1 W/m . K.

(a) On a unit surface area basis, determine the rate of heat transfer into and out of the wall and the rate of change of energy stored by the wall.

(b) If the cold surface is exposed to a fluid at 100 ^{0}C, what is the convection coefficient?