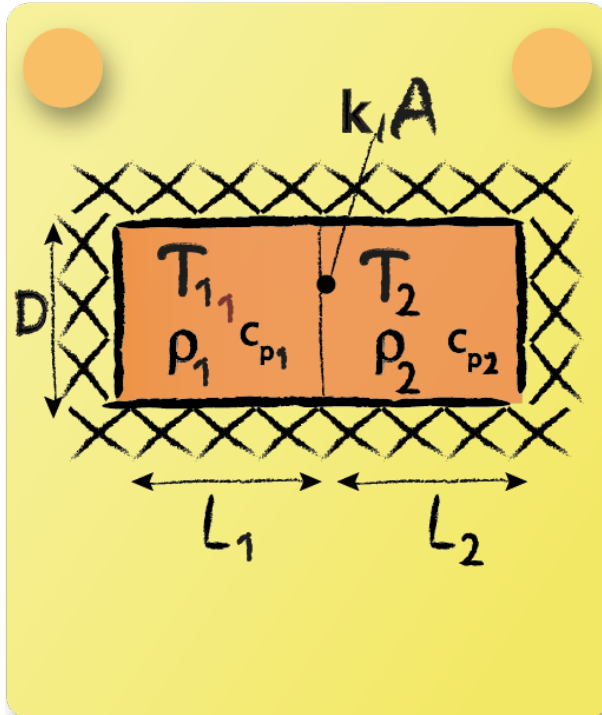


Energy Balance: Task 17



Derive an equation for the temporal development of temperature difference $T_1 - T_2$ of two perfectly stirred tanks that are separated by the interface with area A and heat transmission coefficient k .

To obtain an equation for the temperature difference it is suitable to set up separate expressions for the temperatures via energy balances for each tank. Balances consist of change of internal energy that equals the heat flux through the interface:

$$\rho_1 V_1 c_{p1} \frac{\partial T_1}{\partial t} = -Ak(T_1 - T_2)$$

$$\rho_2 V_2 c_{p2} \frac{\partial T_2}{\partial t} = Ak(T_1 - T_2)$$

1



The temporal derivative of temperature difference is formed by subtracting the equations. Since area, length, density and specific heat capacity are equal for both tanks, those are expressed as general terms. The temporal derivative of temperature difference then reads as:

$$\frac{\partial(T_1 - T_2)}{\partial t} = -\frac{2k}{L\rho c_p}(T_1 - T_2)$$