Week3_Espaho

#Week 3

Task 1 In this week's assignment you should first dfinlize the composite wall question by finding the heat transfer rate, and then solve the same question while the thickness of the brick is increased to 32 cm and comment on the results

A 3 m high and 5 m wide wall consists of long 32 cm 22 cm cross section horizontal bricks (k =0.72 W/m · °C) separated by 3 cm thick plaster layers (k =0.22 W/m · °C).
There are also 2 cm thick plaster layers on each side of the brick and a 3-cm-thick rigid foam (k 0.026 W/m · °C) on the inner side of the wall The indoor and the outdoor temperatures are 20°C and -10°C, and the convection heat transfer coefficients on the inner and the outer sides are h1=10 W/m2 · °C and h2 =40 W/m2 · °C, respectively.Assuming one-dimensional heat transfer and disregarding radiation, determine the rate of heat transfer through the wall.

$$R_i = \frac{1}{h_1 \times A_1} = \frac{1}{10\frac{w}{m^2 \cdot c} \cdot 0{,}25m \cdot 1m} = 0{,}4\frac{c}{w}$$

$$R_f = \frac{Lf}{k_f \cdot A_1} = \frac{0{,}03}{0{,}026x0.25x1} = 4.61\frac{c}{w}$$

$$R_{p_{c_1}} = R_{p_{c_2}} = \frac{L_{p_{c_1}}}{k_p \times A_{p_{c_1}}} = \frac{0.32}{0.22 * 0.015} = 96.97\ °C/W$$

$$R_b = \frac{L_b}{k_b \times A_b} = \frac{0.32}{0.72 * 0.22} = 2.02\ °C/W$$

$$\frac{1}{R_{tot_{parallel}}} = \frac{1}{R_b} + \frac{1}{R_{p_{c_1}}} + \frac{1}{R_{p_{c_2}}}$$

$$\frac{1}{R_{tot_{parallel}}} = \frac{1}{R_b} + \frac{1}{R_{p_{c_1}}} + \frac{1}{R_{p_{c_2}}} = \frac{1}{2.02} + 2\ * \left(\frac{1}{96.97}\right) = 0.52\ °C/W$$

$$\rightarrow \frac{1}{R_{tot_{parallel}}} = 1.03\ W/°C \longrightarrow R_{tot_{parallel}} = \frac{1}{0.52} = \ 0.93°C/W$$

$$R_{P_1} = R_{P_2} = \frac{L_{p_1}}{k_p \times A_{p_1}} = \frac{0.02}{(0.22*0.25)} = 0.363\ °C/W$$

$$R_{\_o} = \frac{1}{h_0 \times A} = \frac{1}{40 * 0.25} = 0.1\ °C/W$$

$$R_{total} = R_i + R_o + 2 * R_{P_1} + R_{tot_{parallel}} + R_{foam}$$

$$R_{total} = 7.76\ ° \frac{C}{W}$$

$$R_{total\ 16} = 6.81\ °C/W$$

$$\dot{Q}_{unit32} = \frac{\left(T_{inff1} - T_{inff2}\right)}{R_{tot}} = \frac{30}{7.76} = 3.86\ W$$

$$\dot{Q}_{unit16} = 4.41W$$

From the result we can conclude that brick main function is structural one. The foam is the most important isolator. And if we change the dimension for dubble, the change won't important.

TASK 2 You should solve again the simplified wall calculation procedure replacing the glass fiber one with urethane rigif foam andwhile replacing the fiberboard with plywood and find the two R_unit values

	Wood	Insulation
Outside Air	0.03	0.03
Wood bevel l.	0.14	0.14
Playwood	0.11	0.11
Urethane rigid foam	No	0.98*90/25
Wood studs	0.63	No
Gypsum board	0.079	0.079
Inside surface	0.12	0.12

$$R_{wood} = 0.03 + 0.14 + 0.11 + 0.079 + 0.12 + 0.63 = 1.11 \frac{m^2 x^0 C}{w}$$

$$R_{insulation} = 0.03 + 0.14 + 3.53 + 0.11 + 0.079 + 0.12 = 4.01 \frac{m^2 x^0 C}{w}$$