WEEK 3

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Task 1

In this week's assignment you should first finalize 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 result.

$$R_i = \frac{1}{10 * 0.25} = 0.4\ C/w$$

$$R_f = \frac{0.03}{0.026 * 0.25} = 4.615\ C/w$$

$$R_{p_{laster\ upper}} = R_{plaster\ down} = \frac{L_{p_{c_1}}}{k_p \times A_{p_{c_1}}} = \frac{0.32}{0.22 * 0.015} = 96.97\ ^\circ\frac{C}{W}$$

$$R_{brick} = \frac{L_b}{k_b \times A_b} = \frac{0.32}{0.72 * 0.22} = 2.02\ ^\circ\frac{C}{W}$$

$$\frac{1}{R_{tot_{parallel}}} = \frac{1}{R_{brick}} + \frac{1}{R_{p_{laster\ upper}}} + \frac{1}{R_{p_{laster\ down}}} = \frac{1}{2.02} + 2 * \left(\frac{1}{96.97}\right) = 0.516\ ^\circ\frac{C}{W}$$

$$\rightarrow \frac{1}{R_{tot_{parallel}}} = 0.516\ \frac{W}{^\circ C} \quad R_{tot_{parallel}} = \frac{1}{0.516} = 0.97^\circ\frac{C}{W}$$

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

$$R_{P_2} = \frac{1}{h_0 \times A} = \frac{1}{40 * 0.25} = 0.1\ ^\circ\frac{C}{W}$$

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

$$R_{total} = 7.781\ ^\circ C/W$$

$$\dot{Q} = \frac{\Delta T}{R_{Tot}} = \frac{30}{7.781} = 3{,}855\ W$$

Comparing this result and the previous one, we can deduce that doubling the brick thickness does not double the resistance. Thus increasing the brick thickness does not affect the heat transfer significantly. Increasing the insulation might have a better effect.

Task 2

You should solve again the simplified wall calculation procedure replacing the glass fiber one with urethane rigid foam and while replacing the fiberboard with plywood and find the two R_unit values.

	Wood Section	Insulation Section
Outside Air	0.03	0.03
Wood Bevel (13mm*200mm)	0.14	0.14
Plywood (13mm)	0.11	0.11
Urethane Rigid Foam Insulation (90mm)	-	(90*0.98) / 25 = 3.528
Wood Studs (90mm)	0.63	-
Gypsum Board (13mm)	0.79	0.79
Inside surface	0.12	0.12

$$R'_{withWood} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12$$
$$= 1.109\ m^2.^\circ\frac{C}{W}$$

$$R'_{withIns} = 0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12$$
$$= 4.007\ m^2.^\circ\frac{C}{W}$$