Week3 YUYUE

1. 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=(0.015+0.22+0.015)*1=0.25 ㎡

$$R_{air,1} = \frac{1}{h_{air,1} * A} = \frac{1}{10 * 0.25} = 0.4\,℃/W$$

$$R_{foam} = \frac{L}{h_f * A} = \frac{0.03}{0.026 * 0.25} = 4.615\,℃/W$$

$$R_{plaster,1} = R_{plaster,2} = \frac{L}{K_p * A} = \frac{0.02}{0.22 * 0.25} = 0.364\,℃/W$$

$$R_{plaster,3} = R_{plaster,4} = \frac{L}{K_p * A_{plastic}} = \frac{0.32}{0.22 * 0.015 * 1} = 96.97\,℃/W$$

$$R_{brick} = \frac{1}{h_b * A} = \frac{0.32}{0.72 * 0.22 * 1} = 2.02\,℃/W$$

$$R_{air,2} = \frac{1}{h_{air,2} * A} = \frac{1}{40 * 0.25} = 0.1\,℃/W$$

$$\frac{1}{R_{parellel}} = \frac{1}{R_{plaster3}} + \frac{1}{R_{plaster4}} + \frac{1}{R_{brick}} = 0.516\,℃/W$$

$$R_{brick} = \frac{1}{0.516} = \frac{0.32}{0.72 * 0.22 * 1} = 1.939\,℃/W$$

$$R_{total} = R_{air,1} + R_{foam} + R_{plaster1} + R_{parellel} + R_{plaster,2} + R_{air,2} = 7.781\,℃/W$$

$$\dot{Q} = \frac{T_1 - T_2}{R_{total}} = \frac{30}{7.781} = 3.86\,℃/W$$

When the thickness of brick is 16mm, $R_{total} = 6.81\,℃/W$

$$\dot{Q} = \frac{T_1 - T_2}{R_{total}} = \frac{30}{6.81} = 1.47\,℃/W$$

Comment: Only add the thickness of a brick inside a composite wall doesn't significantly increase the thermal resistance of the whole wall.

2. Solve again the simplified wall calculation procedure replacing the glass fiber one with urethane rigif foam and while replacing the fiberboard with plywood and find the two R_unit values

	Wood	Insulation
Outside air	0.03	0.03
Wood bevel	0.14	0.14
plywood	0.11	0.11
Urethane rigif foam insulation		3.528
Wood studs	0.63	
Gypsum board	0.079	0.079
Inside surface	0.12	0.12

$R_{total,wood} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = 1.109\,℃/W$

$R_{total,ins} = 0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12 = 4.007\,℃/W$