

Pedram Abedini Arabani

### Week 3 assignment

Question 1: Week 3 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

$$R_{1\text{conv}} = (1/h_1 * A_{1\text{dim}}) = (1/10 \text{ W/mc} + (0.015 + 0.22 + 0.015) \text{ m} * 1 \text{ m}) = 0.4 \text{ C/m}$$

$$R_{\text{Foam}} = (L_{\text{Foam}} / k_{\text{Foam}} * A_{1\text{dim}}) = (0.03 / 0.026 \text{ W/mc} * (0.015 + 0.22 + 0.015) \text{ m} * 1 \text{ m}) \approx 4.615 \text{ c/m}$$

$$R_{\text{plaster up}} = R_{\text{plaster down}} = (L_{\text{plaster up}} / k_p * A_{p\text{up}}) = (0.32 \text{ m} / 0.22 \text{ W/mc} * (0.015 \text{ m} * 1 \text{ m})) \approx 96.97 \text{ c/m}$$

$$R_{\text{Brick}} = (L_{\text{brick}} / k_{\text{brick}} * A_{\text{Brick}}) = (0.32 \text{ m} / 0.72 \text{ W/mc} * 0.22 \text{ m} * 1 \text{ m}) \approx 2.02 \text{ c/w}$$

$$R_{\text{total}} = (1 / R_{\text{plaster up}} + R_{\text{Brick}} + R_{\text{plaster down}}) = 1 / 516 = 1.94 \text{ c/w}$$

$$R_{\text{plaster L}} = R_{\text{plaster R}} = (0.22 \text{ m} / 0.022 \text{ W/mc} * (0.015 + 0.22 + 0.015) \text{ m} * 1 \text{ m}) = 0.36 \text{ c/w}$$

$$R_{2\text{conv}} = (1/h_2 * A_1) = (1 / (40 \text{ W/m}^2 \text{ c} * (0.015 + 0.22 + 0.015) \text{ m} * 1 \text{ m})) = 0.16 \text{ c/w}$$

$$R_{\text{wall}} = 7.83 \text{ c/w}$$

$$Q = (T_i - T_{\infty}) / R_{\text{wall}} = 20 \text{ c} - (-10 \text{ c}) / 7.83 \approx 3.85 \text{ W}$$

By increasing the thickness of brick, there is not significant effect on total wall resistance

Question 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  $R_{\text{unit}}$  values

$$R_{\text{WOOD}} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 \approx 1.11 \text{ m}^2 \text{ c/w}$$

$$R_{\text{urethane}} = 0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12 = 4.00 \text{ m}^2 \text{ c/w}$$