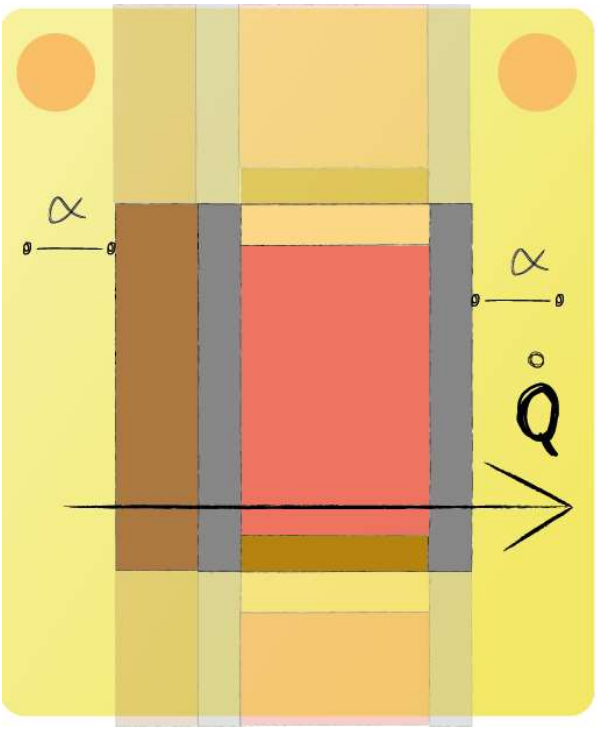
Lecture 7 - Question 4



A wall consists out of bricks (red). The bricks have a thermal conductivity of λ_{brick}. The wall is surrounded by a plaster layer (grey) and has a thermal conductivity of λ_{plaster}. On one side of the wall there is a foam (brown) with a thermal conductivity of λ_{foam}. The constant in- and outdoor temperatures are T_{i} and T_{o}. Assume one-dimensional heat transfer. When determining the rate of heat transfer, which network of resistors is correct for the situation described. Note that no simplifications have been made by simplifying series or parallel networks.

From left to right, first convective heat transfer plays a role. Then heat will be conducted through the foam. After passing through the foam, conduction through the plaster layer occurs. This results in a serial network of three resistors. At some point the heat can be conducted via three paths. The top layer of the plaster, the brick or the bottom layer of the plaster. Implying a parallel network of three resistors will be connected to the three serial resistors. After this parallel network, heat will be conducted through the next plaster layer and will eventually be transported by convective heat transfer at the right side. Implying two additional resistors connected to the parallel network on the right side. Resulting in the resistor network in the figure.