WEEK 4

Wednesday, October 30, 2019 12:00 AM

Politecnico di Milano
MSc. Sustainable Architecture and Landscape Design
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Task 1: you should complete the modified example of simplified wall calculations that you went through in the assignment of week 3 and find the total heat transfer through wall

$$R'_{withWood} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = 1.109\ m^2.°\frac{C}{W}$$
$$R'_{withIns} = 0.03 + 0.14 + 0.11 + 3.53 + 0.079 + 0.12 = 4.009\ m^2.°C/W$$

$$\frac{1}{R_{total}} = \frac{1}{R_{wood}} + \frac{1}{R_{ins}}$$
$$U_{wood} = \frac{1}{R'_{wood}} = \frac{1}{1.109} = \mathbf{0.9017}\frac{\boldsymbol{W}}{\boldsymbol{m^2°C}}$$
$$U_{ins} = \frac{1}{R'_{ins}} = \frac{1}{4.009} = \mathbf{0.2494}\frac{\boldsymbol{W}}{\boldsymbol{m^2°C}}$$

$$U_{tot} = U_{wood} \times \frac{A_{wood}}{A_{tot}} + U_{ins} \times \frac{A_{ins}}{A_{tot}} = 0.25 \times U_{wood} + 0.75 \times U_{ins}$$
$$U_{tot} = 0.25 \times 0.9017 + 0.75 \times 0.2494 = \mathbf{0.4123}\frac{\boldsymbol{W}}{\boldsymbol{m^2°C}}$$

$A_{tot} = 50 * 2.5 = 125m^2$
20% of the wall is glazing ---- 0.8
$\Delta T = 22 - (-2) = 24°C$

$$Q_{tot} = U_{tot} \times A_{tot} \times \Delta T = 0.4123 * (125 * 0.8) * 24 = \mathbf{989.52}\ \boldsymbol{W}$$

Task 2 In 2 pages you should write a summary (in your own words) of what you have learnt in this session about radiation and radiative heat transfer

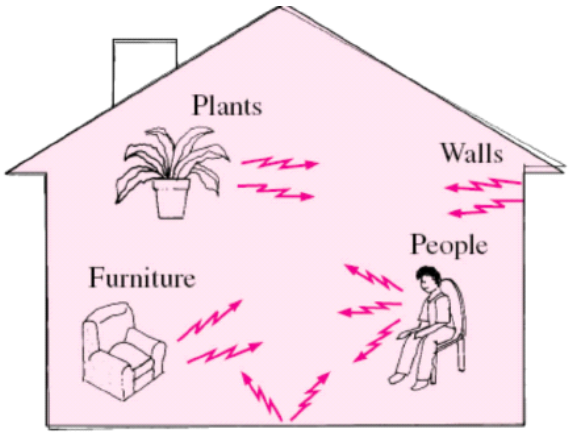
Radiation and heat transfer

Radiation comes from the sun especially, but every object creates radiation. This is a big problem and is important to reduce, reducing only conduction and convection is not enough. Electromagnetic waves transport energy just like other

waves and they are characterized by their frequency or wavelength. The shorter the wavelength, the stronger the frequency.

Thermal Radiation

Is a electromagnetic radiation pertinent to heat transfer.

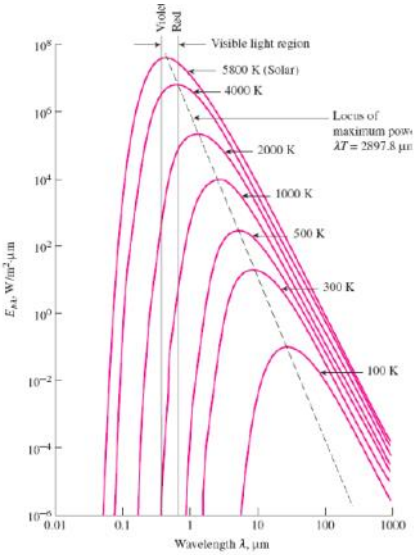


Everything around us constantly emits thermal radiation.

Radiation energy emitted by a blackbody: Eb (T)= oT^4, is exponentially increased by temperature!

Blackbody emissive power is always constant.

So, the waves when you have radiation depends fundamentally on temperature, and the emising power depends on the wavelength and the temperature. The lower the wavelength the higher the energy.



The variation of the blackbody emissive power with wavelength for several temperatures.