Demre Ertem Weekly Submission 4

29 Ekim 2019 Salı 00:17

- Determine the overall unit thermal resistance (the *R*-value) and the overall heat transfer coefficient (the *U*-factor) of a wood frame wall that is built around 38-mm 90-mm wood studs with a center-to-center distance of 400 mm. The 90-mm-wide cavity between the studs is filled with Urithane rigid insulation. The inside is finished with 13-mm gypsum wallboard and the outside with 13 mm plywood and 13-mm 200-mm wood bevel lapped siding. The insulated cavity constitutes 75 percent of the heat transmission area while the studs, plates, and sills constitute 21 percent. The headers constitute 4 percent of the area, and they can be treated as studs.
- Also, determine the rate of heat loss through the walls of a house whose perimeter is 50 m and wall height is 2.5 m in Las Vegas, Nevada, whose winter design temperature is -2 C. Take the indoor design temperature to be 22 C and assume 20 percent of the wall area is occupied by glazing. Find the total heat transfer through wall.

	Wood	Insulation
Outside Air	0.03	0.03
Wood bevel l.	0.14	0.14
plywood(13mm)	0.11	0.11
Urithane Rigid foam Ins.	No	0.98*90/25=3.53
Wood studs	0.63	No
Gypsum board	0.079	0.079
Inside surface	0.12	0.12

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

$$R'_{withIns} = 0.03 + 0.14 + 0.11 + 3.53 + 0.079 + 0.12 = 4.007\ m^2.\ °C/W$$

$$U_{wood} = 1/R'_{withWood} = \frac{1}{1.109 m^2.\ °\frac{C}{W}} = 0{,}9017 W/m^2.\ °C$$

$$U_{insulation} = 1/R'_{withIns} = \frac{1}{4.007 m^2.\ °\frac{C}{W}} = \frac{0.2496W}{m^2.°C}$$

$$1/R_{total} = 1/R_{wood} + 1/R_{insulation}$$

$$A_{total}/R'_{total} = A_{wood}/R'_{wood} + A_{insulation}/R'_{insulation}$$

$$U_{total} = U_{wood} * A_{wood}/A_{total} + U_{insulation} * A_{insulation}/A_{total}$$
$$= (21\% + 4\%) * U_{wood} + 75\% * U_{insulation}$$
$$= 25\% * 0.9017 \frac{W}{m^2.°C} + 75\% * 0.2496 \frac{W}{m^2.°C} = \frac{0.4126W}{m^2.°C}$$

Overall unit thermal resistance

$$R_{value} = 1/U_{total} = 1/0.4126 W/m^2.\ °C = 2.4237 m^2.\ °\frac{C}{W}$$

The rate of heat loss through the walls

$$Q_{total} = U_{total} * A_{total} * \Delta T$$
$$= 0.4126 W/m^2.\ °C * 50 * 2.5m * 0.8 * (22 - (-2)) = 990.2W$$

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

Radiation is different than conductivity and convection, so material does not necessary to calculate. In addition to solidification, radiation transfer occurs in liquids and gases.

Molecules and atoms of the medium can absorb, reflect, or transmit the radiation energy.If the material medium is a vacuum, Radiation energy which is molecular or atomic will not weaken and so, will be transmitted totally. That's why, radiation transfer is more efficient in a vacuum.

Heat Transfer by Thermal Radiation

Heat transfer from high temperature to something with a lower temperature, but sometimes elements cannot physical contact with each other directly. In this circumstances, Hot object cool with their surroundings and reach thermal equilibrium. This is heat thermal mechanism of the radiation.

Changing electrical currents cause electric and magnetic fields. These fields are called electromagnetic waves or electromagnetic radiation. All physical substances in solid, liquid, or gaseous states can emit energy via a process of electromagnetic radiation because of vibrational and rotational movements of their molecules and atoms.

Electromagnetic waves transfer energy like other waves and frequency or wavelength is crucial.

The type of electromagnetic radiation suitable for heat transfer is thermal radiation emitted as a result of the energy of molecules, atoms and electrons of a substance. Thermal radiation emission rise with positively accelerated temperature. Temperature leads the process.

Elements which have temperature higher than zero spread to suuroundings perpetually. Everything around us constantly emits thermal radiation.

A body that emits some radiation in the visiblerange is called a lightsource. The electromagnetic radiation comes from Sun is solar radiation. Light with ultra violet and infrared is composed of about half of solar radiation.

The radiation emitted by bodies at room temperature falls into the infrared region of the spectrum, which extends from 0.76 to 100µm. The ultraviolet radiation includes the low-wavelength end of the thermal radiation spectrum and lies between the wavelengths 0.01 and 0.40µm.

People should avoid from ultraviolet rays which can kill microorganisms and bring about serious damage to not only humans and but also other livingbeings. About12 percent of solar radiation is in the ultraviolet range. The ozone (O_3) layer in the atmosphere acts as a protective blanket and absorbs most of this ultraviolet Radiation.

Different colors, volume can lie in different amounts of radiation per surface area. A black body emits the maximum amount of radiation by a surface at a given temperature. It is a utopian structure to serve as a standard for comparing the radiative properties of real surfaces.

Black is a technological, excellent emitter and radiation absorber. The black body absorbs all incident radiation irrespective of wavelength and direction.