week3_TPletneva

22 октября 2019 г.   10:16

1. Finding the heat transfer rate of the composite wall (exercise started in class):

1) Finding total resistance of the wall:

Rtotal=Rconv1+Rfoam+Rplaster1+Rtotal(plaster^;brick;plaster$_{v}$)+Rplaster2
+Rconv2
Rtotal=1/(10*0.25)+0.03/(0.026*0.25)+0.02/(0.22*0.25)+0.97+0.02/(0.22*0.25)+
1/(40*0.25)
Rtotal=0.4+4.61+0.36+0.97+0.36+0.1= 6.8 (C/W)

2) Finding the rate of heat transfer through the wall:

Q=(Tinf1-Tinf2)/6.8
Q=(20-(-10))/6.8=30/6.8=**4.4117 (W)**

2. Solving the same exercise with the thickness of the brick = 32(cm) with comments on the results:

1) Finding the total resistance of the 3 parallel layers:

Rplaster^=Rplaster$_{v}$=Lplaster^/(kplaster^*Aplaster^)=0.32/(0.22*0.015)=96.96;
1/96.96=0.01 C/W

Rbrick=Lbrick/(kbrick*Abrick)=0.32/(0.72*0.22)=2.02 C/W;
1/2.02=0.49 C/W

Rtotal(3layers in parallel)=0.01*2+0.49=0.51;
1/0.51=1.96 C/W

2) Finding the total resistance of the wall:

Rtotal=Rconv1+Rfoam+Rplaster1+Rtotal(3 layers in parallel)+Rplaster2+Rconv2
Rtotal=0.4+4.61+0.36+1.96+0.36+0.1=7.79 C/W

3) Finding the rate of heat transfer through the wall:

Q=(Tinf1-Tinf2)/7.79
Q=(20-(-10)/7.79=30/7.79=**3.851 W**

4) Comments:

Comparing the result of the current exercise (thickness of the brick=32(cm)), with the original task (brick=16(cm)), it is evident, that increasing the thickness of the brick only slightly increases the total resistance of the wall, and the rate of heat transfer through it drops insignificantly. The main parameter, that could change the rate more, is the thickness of the foam layer.

3. Solving the simplified wall calculations procedure with a replacement of the *glass fiber one > urethane rigid foam*; *fiberboard > plywood*, and finding the two R_unit values :

	WOOD	INSULATION
Outside air	0.03	0.03
Wood bevel (13*200 (mm))	0.14	0.14
Plywood (13mm)	0.11	0.11
Urethane rigid foam (90mm)	-	3.528
Wood studs (90mm)	0.63	-
Gypsum (13mm)	0.079	0.079
Inside air	0.12	0.12
TOTAL R_unit values (m^2*C)/W:	**1.109**	**4.007**