

Week6-Azra Ozyurt

8 Kasım 2019 Cuma 21:10

TASK 1

$$\sigma = 5.67 \times 10^{-8}$$

$$\epsilon_1 = \epsilon_2 = \epsilon_{3,1} = \epsilon_{3,2} = 0.1$$

$$T_1 = 800K$$

$$T_2 = 500K$$

IF ALL THE E VALUES ARE EQUAL

How many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

$$\frac{\dot{Q}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} \quad \frac{\dot{Q}}{A} = 5.67 \times 10^{-8} \frac{800^4 - 500^4}{\frac{1}{0.1} + \frac{1}{0.1} - 1} = 1035.81 \frac{W}{m^2}$$

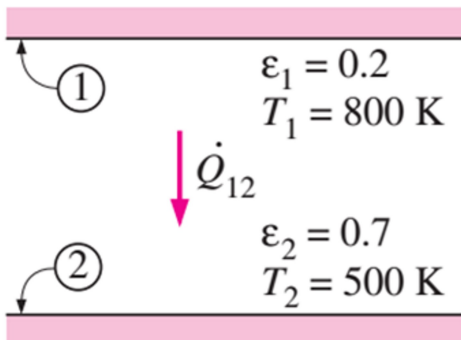
1035,81 * %1 = 10,35

$$\frac{\sigma(T_1^4 - T_2^4)}{(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1)(N + 1)} = \frac{1}{(N + 1)}$$

$$\frac{1}{(N + 1)} \dot{Q} = \frac{1}{100} \dot{Q}$$

99 SURFACES TO LOWER THE RADIATION TO 1%

IF NOT:

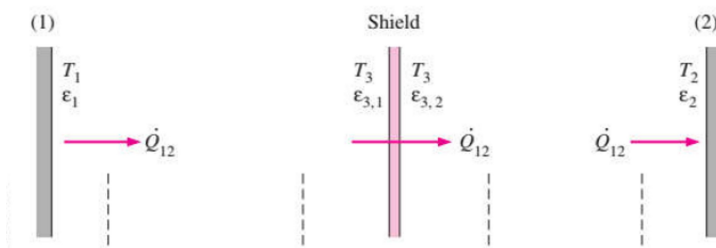


$$\sigma = 5.67 \times 10^{-8}$$

NET HEAT TRANSFER WITHOUT SHIELDS?

$$\frac{\dot{Q}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1}$$

$$\frac{\dot{Q}}{A} = 5.67 \times 10^{-8} \frac{800^4 - 500^4}{\frac{1}{0.2} + \frac{1}{0.7} - 1} = 3625.4 \frac{W}{m^2}$$



How many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

$$3625.4 * \%1 = 36.25$$

$$\frac{\dot{Q}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + \left(\frac{1}{\epsilon_{3,1}} + \frac{1}{\epsilon_{3,2}} - 1\right) + \left(\frac{1}{\epsilon_{4,1}} + \frac{1}{\epsilon_{4,2}} - 1\right) + \dots + \left(\frac{1}{\epsilon_{n,1}} + \frac{1}{\epsilon_{n,2}} - 1\right)}$$

$$= 5.67 \times 10^{-8} \frac{800^4 - 500^4}{\left(\frac{1}{0.2} + \frac{1}{0.7} - 1\right) + n \cdot \left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)} = 36.25$$

$$\frac{19680.57}{5.42 + 19n} = 36.25$$

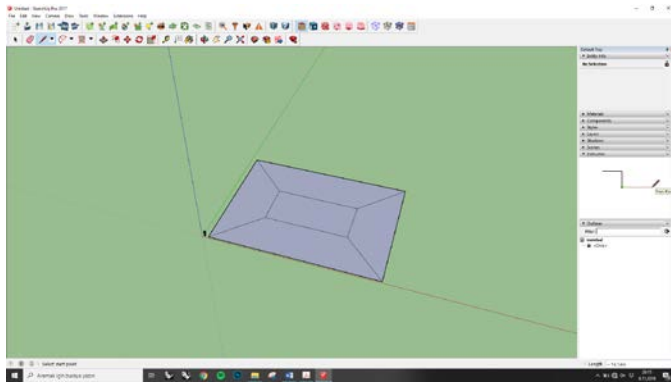
$$19680.57 = 36.25(5.42 + 19n)$$

$$542.91 - 5.42 = 19n$$

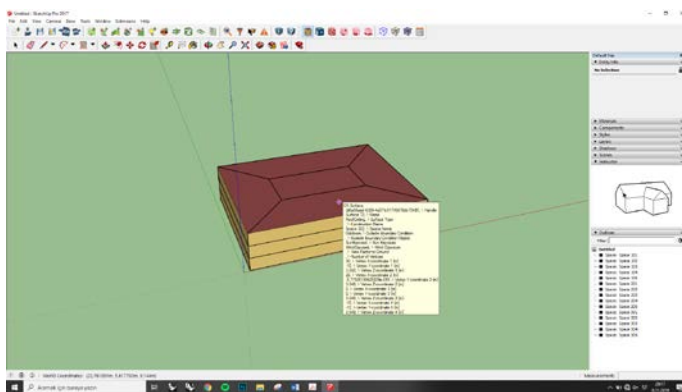
$$537.49 = 19n$$

$$28.1 = n$$

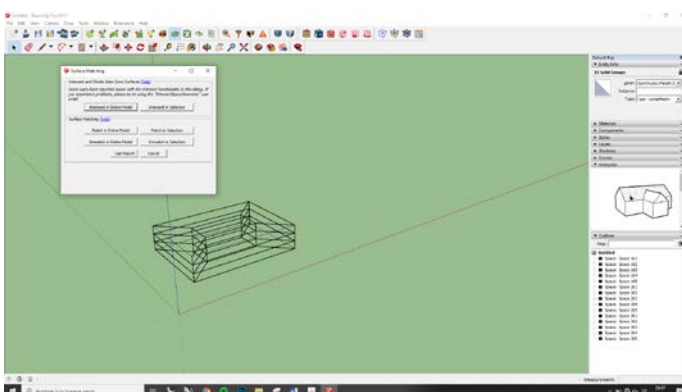
28 SHIELDS WITH $\epsilon = 0.1$ IN ORDER TO LOWER THE RADIATIVE HEAT TRANSFER TO %1



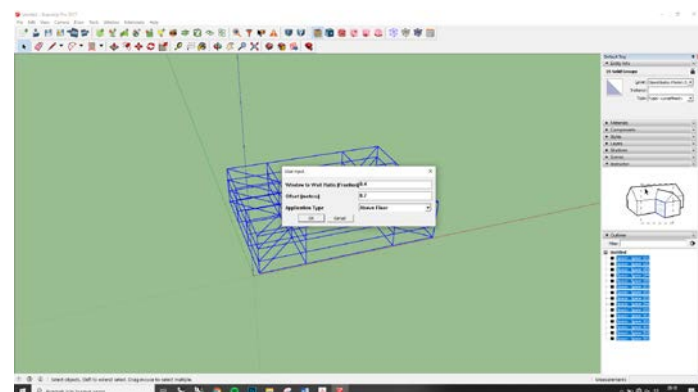
First, in sketch up I created the floor plan of a simple office building. Open offices and the break room.



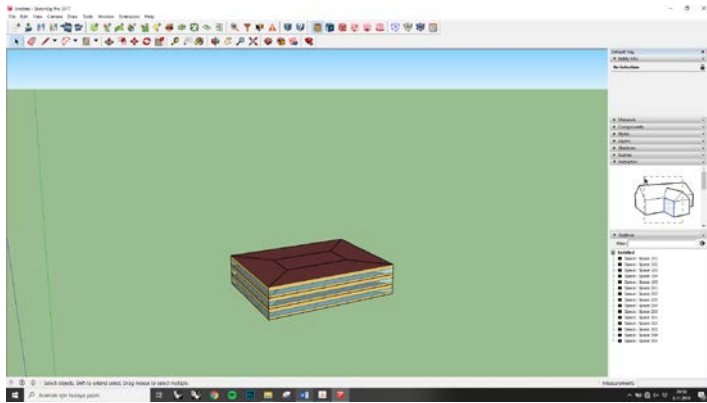
Then I clicked the create spaces from diagram, floor height 10' and 3 floors. I can see the information with the info tool.



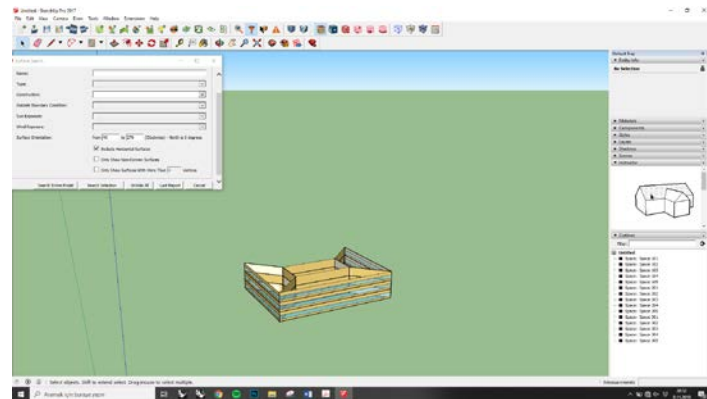
In order to define interior and outer walls, I used surface matching tool.



Then using the extensions tab I added the window ratios to the spaces of 70%

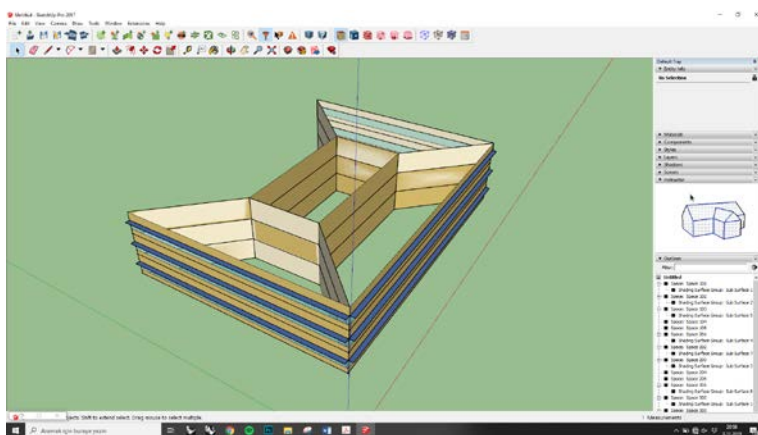


Windows are created.

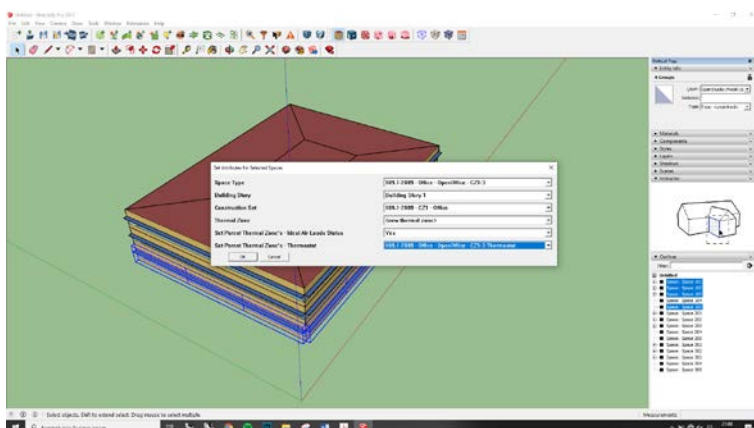


To create shadings for necessary facades, I use the surface selection, selecting all the facades but the north.

With 45-270

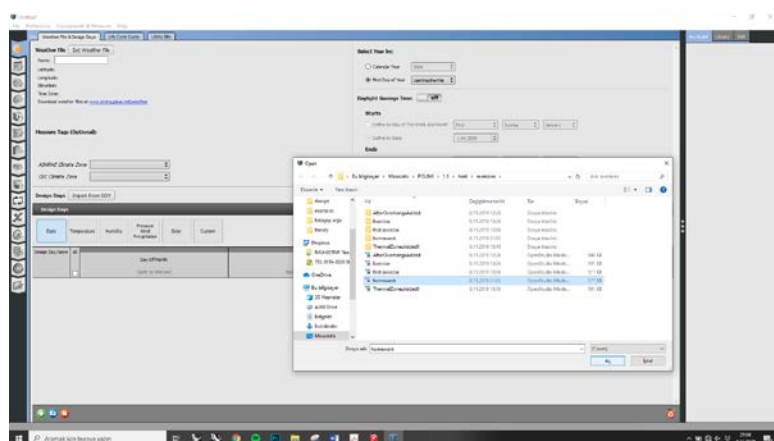


The facades are selected, I used the extensions window to add overhangs (external shadings.)

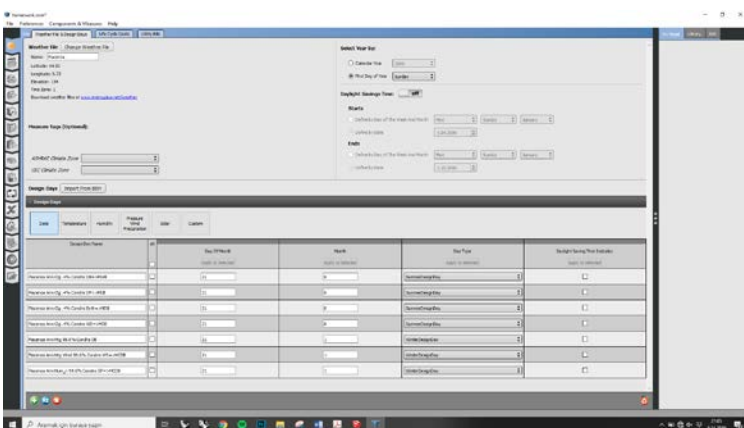


When the shadings are done, I use the side bar to select the spaces and define thermal zones.

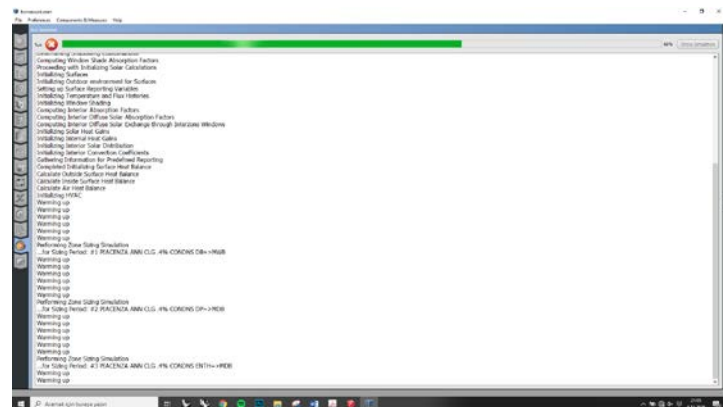
I am done with sketch up. Saved my progress.



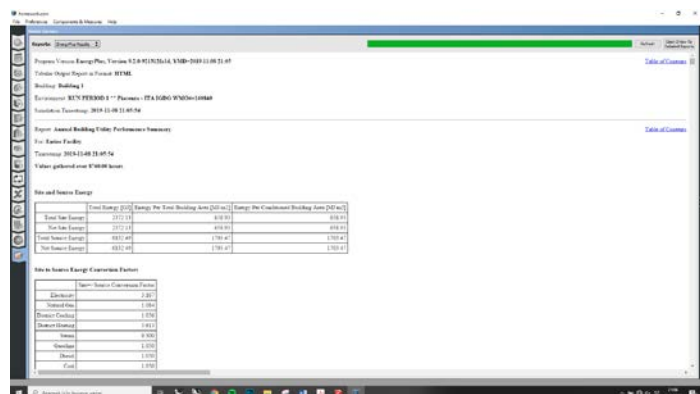
I open OpenStudio and open my file which I created in Skethup.



I add weather and design days in the file by importing.



I run the model.



I have my results in the last tab.