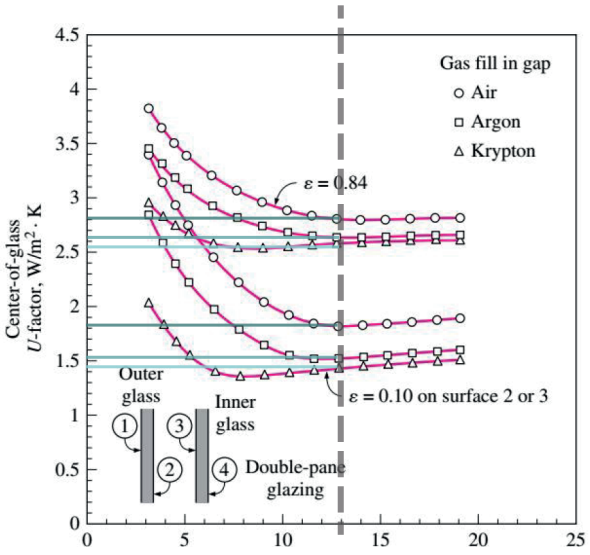
Savinetti Simone 10542075 Week 8 Assignment

Task 1 Using the diagrams given in the presentation calculate how much (%) is the effect of applying different modifications (changing the gas, adding an extra pane, using a low emissivity coating) on the U value with respect to a benchmark case of double layer with air and no coating ? (keep the gap thickenss to be 13 mm).



- Air => ε = 0.84 ; U_{factor}= 2,8 W/m²*K 100%
- Argon => ε = 0.84 ; U_f= 2,65 W/m²*K 86,11%
- Kripton => ε = 0.84 ; U_f= 2,57 W/m²*K 77,77%

Changing the gas inside the panel, and considering a double layer window, we discover that:

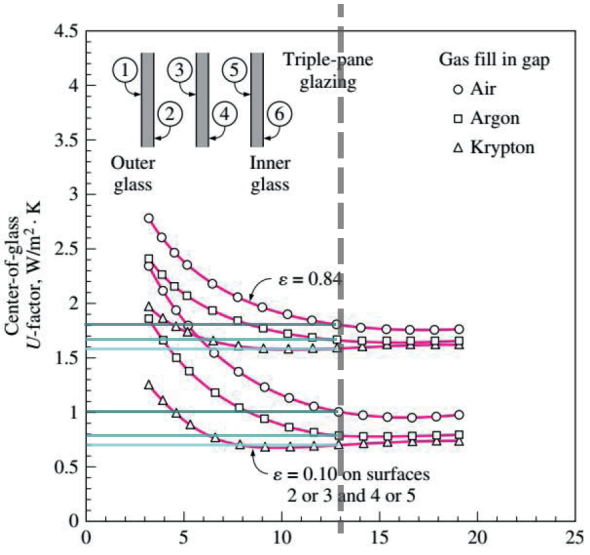
U-factor decrase by 13,89 % with Argon and by 22,23 % using Kripton.

If we consider the same double layer window, whit an extra coat the result are:

- Air => ε = 0.1 ; U_{factor}= 1,81 W/m²*K 64.64%
- Argon => ε = 0.1 ; U_f= 1,52 W/m²*K 54.28%
- Kripton => ε = 0.1 ; U_f= 1,43 W/m²*K 51.07%

Chianging the gas inside the panel, and considering a double layer window and using a low emissivity coating we discover that:

U-factor decrase by 35,36 % with Air, by 45,72% using Argon and by 48,93 % using Kripton.



- Air => ε = 0.84 ; U_{factor}= 1,8 W/m²*K 64,28%
- Argon => ε = 0.84 ; U_f= 1,68 W/m²*K 60%
- Kripton => ε = 0.84 ; U_f= 1,59 W/m²*K 56,78%

Changing the gas inside the panel, and considering a tripl layer window, we discover that:

U-factor decrase by 35,72 % with air, by 40 % using Argon and by 43,22 % using Kripton.

If we consider the same double layer window, whit an extra coat the result are:

- Air => ε = 0.84 ; U_{factor}= 1 W/m²*K 35.71%
- Argon => ε = 0.84 ; U_f= 0,79 W/m²*K 28.21%
- Kripton => ε = 0.84 ; U_f= 0,7 W/m²*K 25%

Chianging the gas inside the panel, and considering a double layer window and using a low emissivity coating we discover that:

U-factor decrase by 64,29 % with Air, by 71,79 % using Argon and by 75 % using Kripton.

Task 2. Consider the house that we analysed in the last two examples, calculate the heating and cooling load of the other windows which are fixed 14.4 m2 on the west, fixed 3.6 m2 on the south and an operable 3.6 m2 on the south (the same window and frame type). How much does the total value change if I change the frame of the window from wooden one to aluminium ?

Heating case A (fixed 14,40 m² on the west)

From the class example: ΔT heating= 24,8°C

$U_{windowswest}$ = 2,84 W/m2. K
$HF= U_{windowswest} \times \Delta T_{heating}$
2,84 W/m² x 24,8°C
70,43 W/m²
$Q_{windowswest} = HF_{windowswest} \times A_{windowswest}$
70,43 W/m² x 14,40 m²
1014,19W

Answer:
The heating value for the fixed window of 14,40m², on the west is 1014,19W

Heating case B (fixed 3,60 m² on the south)

$Q_{windowssouth} = HF_{windowsouth} \times A_{windowssouth}$
70,43 W/m² x 3,60 m²
253,54 W

Answer:
The heating value for the fixed window of 3,60m², on the west is 1014,19W

Heating case C (operable 3,60 m² on the south)

$U_{windowsouth}$ = 2,87 W/m2. K
$HF= U_{windowsouth} \times \Delta T_{heating}$
2,87 W/m² x 24,8°C
71,17 W/m²
$Q_{windowswest} = HF_{windowswest} \times A_{windowswest}$
71,17 W/m² x 3,60 m²
256,23 W

Answer:
The heating value for the fixed window of 3,60 m², on the west is 256,23W

Cooling case A (fixed 14,40 m on the west)

From the class example: ΔT cooling= 7,9°C

$U_{windowswest}$ = 2,84 W/m². K
HF= $U_{windowswest}$ x $\Delta T_{cooling}$
2,84 W/m² x 7,9°C
22,43 W/m2
$Q_{windowswest}$ = $HF_{windowswest}$ x $A_{windowswest}$
22,43 W/m² x 14,40 m²
322,99W
$CF_{windowswest}$ = ($U_{windowswest}$ x (ΔT - (0,46DR))) + (PXI x SHGC x IAC x FFs)
2,84 W/m². C x (7,9°C - 0,46 x 11,90°C)
2,84 W/m². C x (7,9°C - 5,47°C)
2,84 W/m². C x 2,43°C
6,90 W/ m²
(PXI x SHGC x IAC x FFs)=
747 x 0,54 x 1 x 0,56=
225,89 W/m²
Total CF= 6,90 W/m² + 225,89 W/m²=
232,79 W/m²
TOTAL Q= $CF_{windowswest}$ x $A_{windowswest}$
232,79 W/m² x 14,40 m² = 3352,17W
Answer:
The cooling value for the fixed window of 14,40m², on the west is 3352,17W

Cooling case B (fixed 3,60 m² on the south)

$U_{windowssouth}$ = 2,84 W/m². K
HF= $U_{windowsouth}$ x $\Delta T_{cooling}$
2,84 W/m² x 7,9°C
22,43 W/m2
$Q_{windowssouth}$ = $HF_{windowssouth}$ x $A_{windowsouth}$
22,43 W/m² x 3,60 m²
80,74 W
$CF_{windowssouth}$ = ($U_{windowssouth}$ x (ΔT - (0,46DR))) + (PXI x SHGC x IAC x FFs)
2,84 W/m². C x (7,9°C - 0,46 x 11,90°C)
2,84 W/m². C x (7,9°C - 5,47°C)
2,84 W/m². C x 2,43°C
6,90 W/ m²
(PXI x SHGC x IAC x FFs)=
557 x 0,46 x 1 x 0,47=
120,20 W/m²
Total CF= 6,90 W/m² + 120,20 W/m²=
127,10 W/m²
TOTAL Q= $CF_{windowssouth}$ x $A_{windowssouth}$
127,10 W/m² x 3,60 m² = 457,56W
Answer:
The cooling value for the fixed window of 3,60m², on the south is 457,56W

Heating case C (operable 3,60 m² on the south)

$U_{windowssouth}$ = 2,84 W/m². K

HF= $U_{windowsouth}$ x $\Delta T_{cooling}$

2,84 W/m² x 7,9°C

22,43 W/m2

$Q_{windowssouth}$ = $HF_{windowssouth}$ x $A_{windowsouth}$

22,43 W/m² x 3,60 m²

80,74 W

$CF_{windowssouth}$ = ($U_{windowssouth}$ x (ΔT - (0,46DR))) + (PXI x SHGC x IAC x FFs)

2,84 W/m². C x (7,9°C - 0,46 x 11,90°C)

2,84 W/m². C x (7,9°C - 5,47°C)

2,84 W/m². C x 2,43°C

6,90 W/ m²

(PXI x SHGC x IAC x FFs)=

556 x 0,54 x 1 x 0,47=

141,11 W/m²

Total CF= 6,90 W/m² + 141,11 W/m²=

148,01 W/m²

TOTAL Q= $CF_{windowssouth}$ x $A_{windowssouth}$

148,1W/m² x 3,60 m² = 532,84W

Answer:

The cooling value for the fixed window of 3,60m², on the south is 532,84 W