Comparison of convective surface heat transfer coefficients in IDA ICE and CFD.

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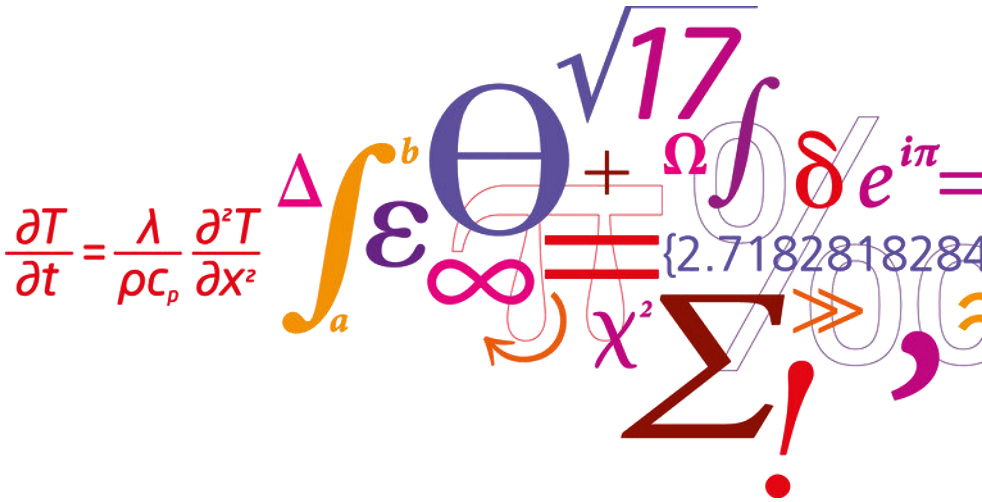

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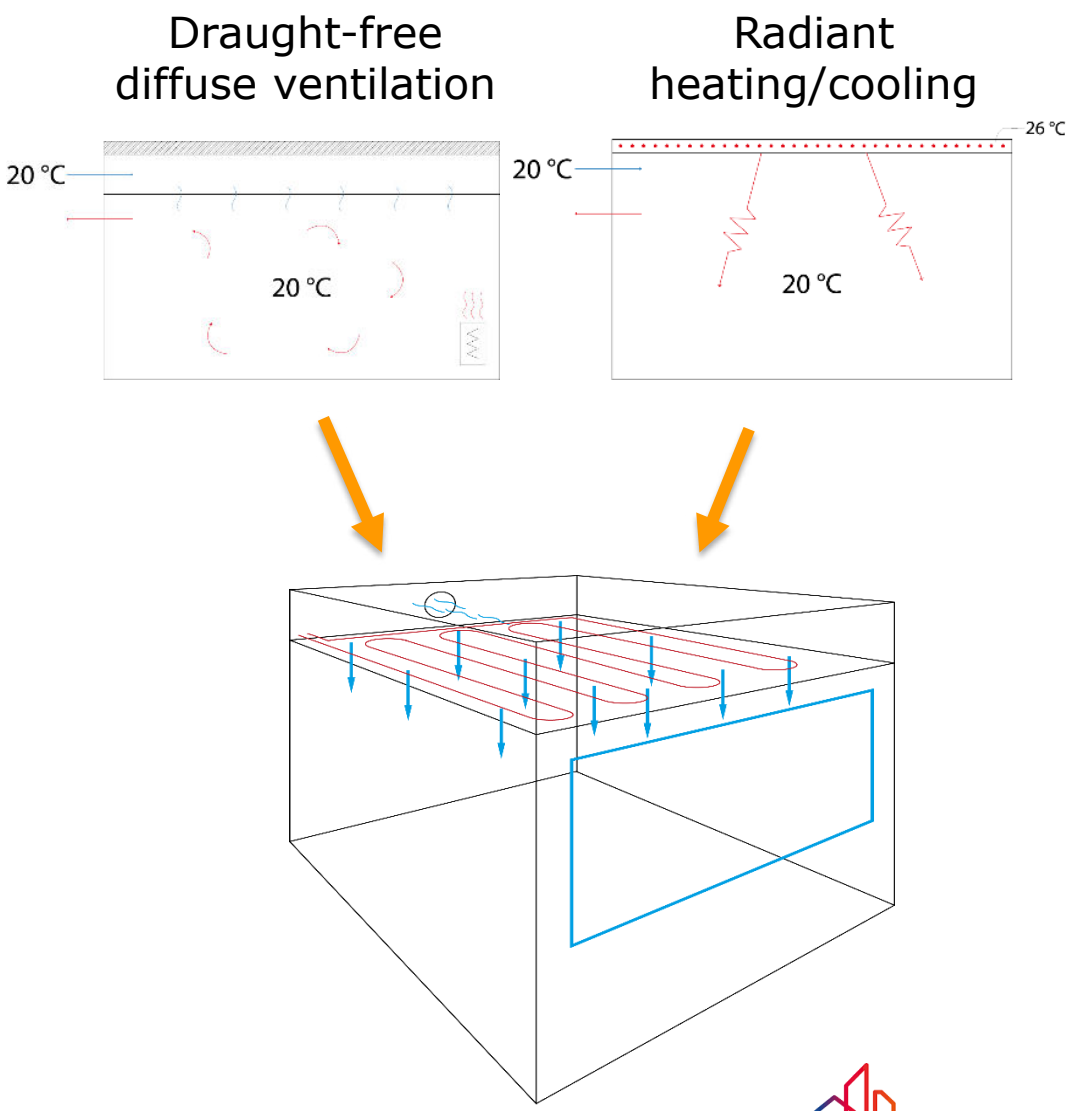
SAINT-GOBAIN

1. Introduction

- Near-Zero Energy buildings by 2020
- Focus on comfort and productivity
- Challenges in simulation tools.
- IDA ICE automatic algorithm for building spaces with typically ACH of 0-7 h^{-1}.
- Diffuse ventilation plenum has ACH between 10-40 h^{-1}.
- HTC in small enclosures



2. Method – IDA ICE

- IDA ICE, internal convective heat transfer coefficients

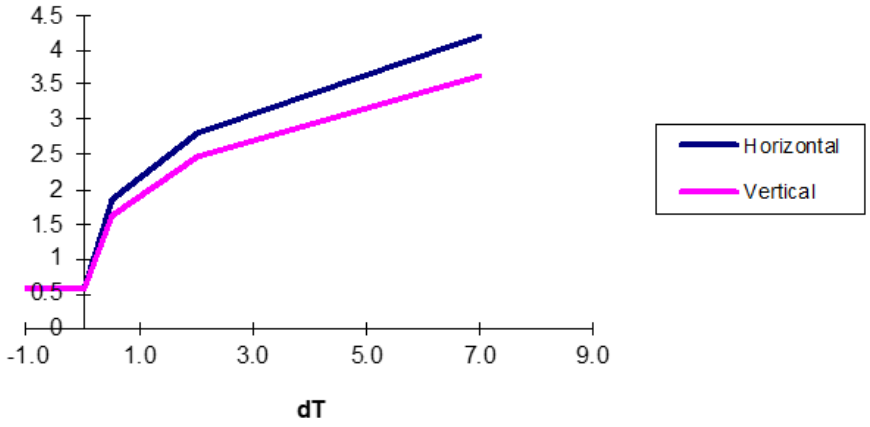
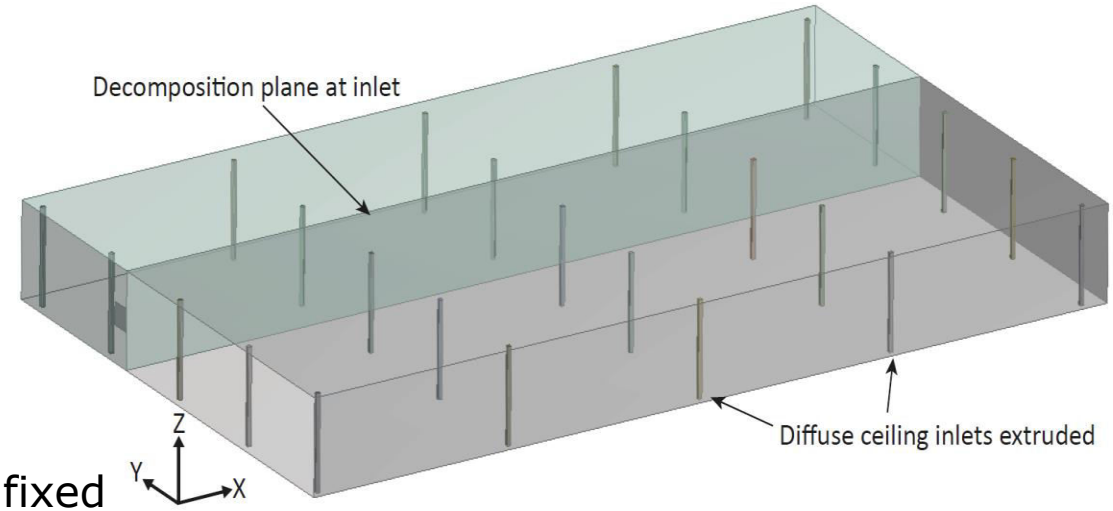


Figure 1. The convective heat transfer coefficient. (BRIS)

- CD-model: Floor $h = 3.873 \cdot r + 0.082 \cdot ACH^{0.98}$
- Ceiling $h = 2.234 \cdot r + 4.099 \cdot ACH^{0.503}$

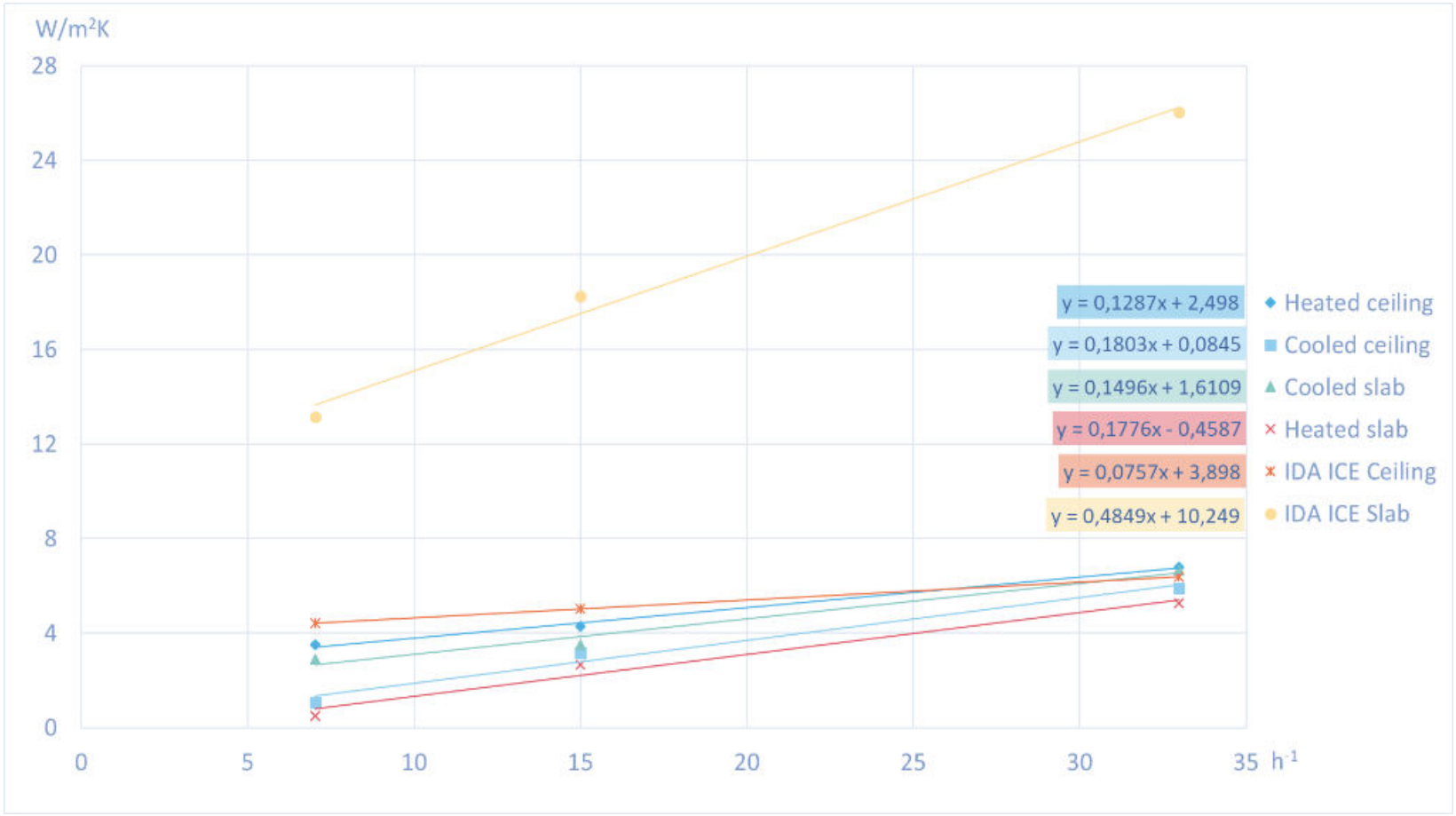
Where $r = \mathrm{MIN}(5, ACH)/5)$

2. Method – CFD



- ANSYS CFX
- Ceiling and slab with fixed temperature:
  - Cooling: 10 C
  - Heating: 30 C
- Air temp.: 20 C
- Diffuse ventilation – uniform flow in CFD.

3. Results


W/m²K
28
24
20
16
12
8
4
0
0
5
10
15
20
25
30
35
h⁻¹
y = 0,1287x + 2,498
Heated ceiling
y = 0,1803x + 0,0845
Cooled ceiling
y = 0,1496x + 1,6109
Cooled slab
y = 0,1776x - 0,4587
Heated slab
y = 0,0757x + 3,898
IDA ICE Ceiling
y = 0,4849x + 10,249
IDA ICE Slab

5. Conclusion

- Large differences between CFD and IDA ICE
- HTC module in IDA ICE could be expanded for small enclosures
- A way to make your own function for HTC in IDA ICE.
  - Which hopefully Mika, already have a solution for.
- Used the numbers from my CFD calculation and added them as fixed numbers in IDA ICE.

Questions?