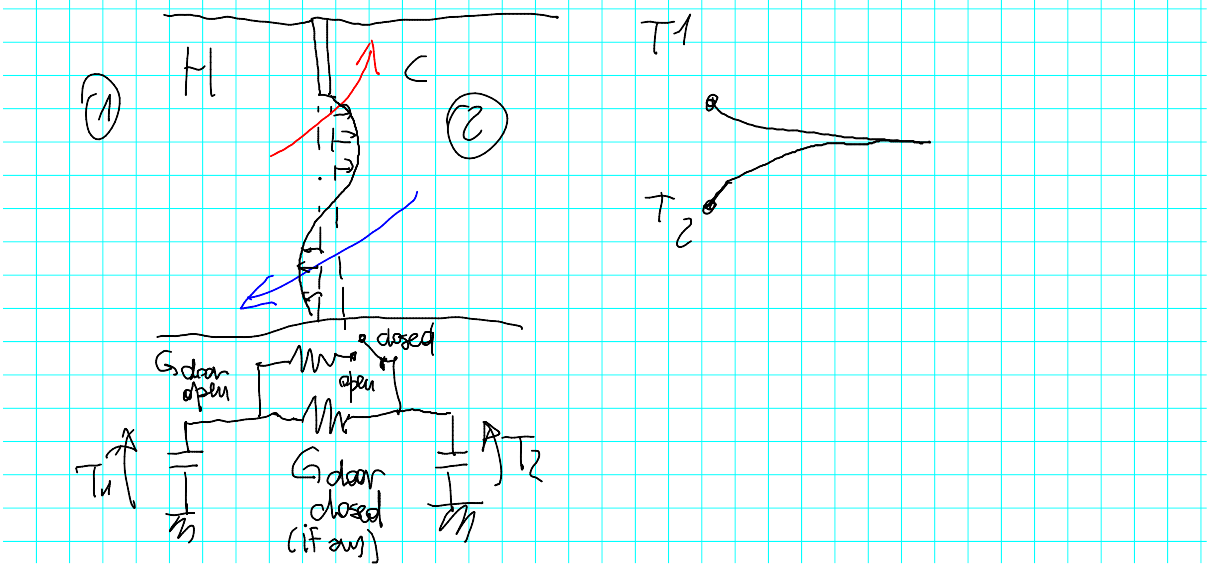
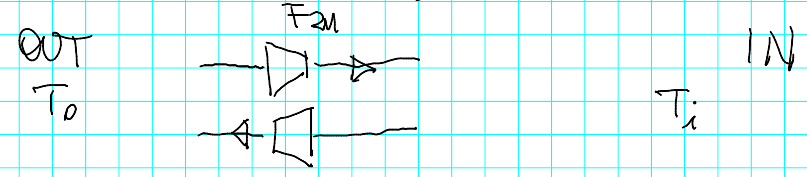
16/05/2019



2 Air renovation

double effect



Hyp: two flows equal

Power $\dot{m} c T_o w \longrightarrow$

$\longleftarrow \dot{m} c T_i w$

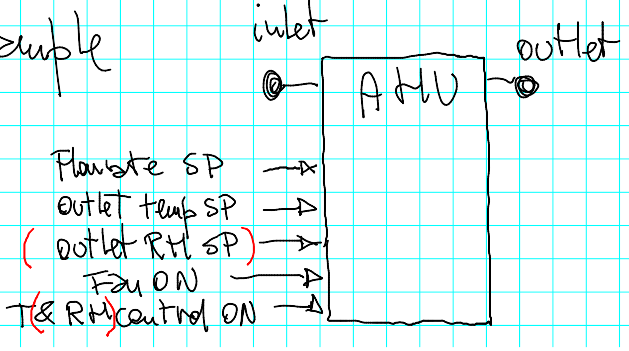
3 net power (In to out)

$$P_{io} = \underbrace{\dot{m} c}_{\text{equivalent conductance depending on flowrate}} (T_i - T_o)$$

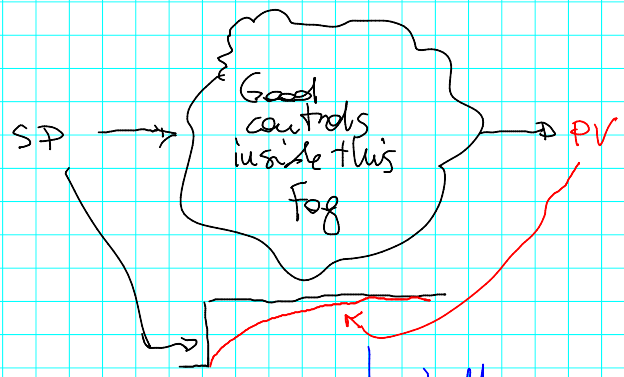
Modelling of controlled machines

Most machines (heaters, air conditioners, chillers, AHUs etc ...) come with controls aboard.

example



We do not want to model the internal physics



may depend on flowrate

↑

↳ tell me a settling time

(or) turn the machine on, set to AUTO & test & get it

Back to AHU example

$T_{control\ ON}$: $T_{out} + \tau_{TC}\dot{T}_{out} = T_{out\,SP}$ $\quad T_{outSP} \rightarrow \boxed{\frac{1}{1+s\tau}} \rightarrow T_{out}$

$T_{control\ OFF}$: $T_{out} + \tau_{TF}\dot{T}_{out} = T_{IN}$

$W_{control\ ON}$: $W + \tau_{WC}\dot{W} = W_{SP}$

$W_{control\ OFF}$: $W + \tau_{WF}\dot{W} = 0$

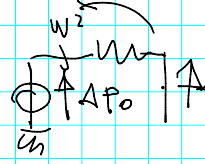
τ_{TC}: TC of T control, closed loop

τ_{TF}: " For Free motion of T_{out} toward T_{IN}

What about consumption?

Fan: $W_{Fan} = \dot{V}_{Flowrate} \cdot \Delta p = \frac{\dot{m}}{\rho} \Delta p$

Δp ~ parameter OR $\sim \omega^2$ $\Rightarrow \sim \left(\frac{\dot{m}}{\rho}\right)^3$



8 Heating:

We control T_{OUT}

T_{in} depends on the rest of the model

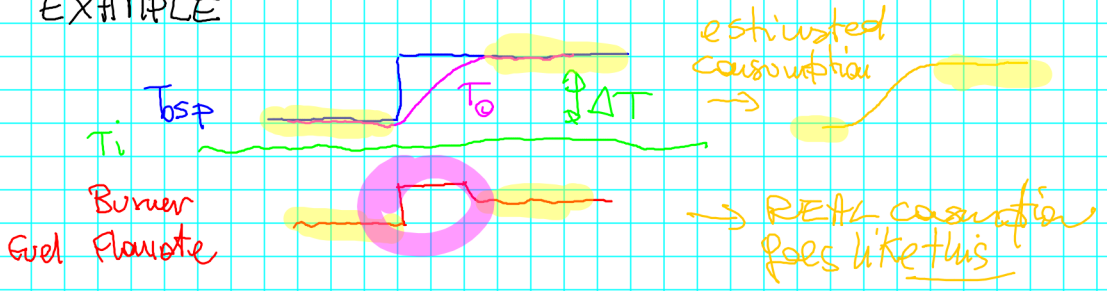
We also control W

$$W_{heat} = c\,W\,(T_{out} - T_{in})$$

⇓ Then the heat consumptions may be obtained by dividing by some efficiencies

Are we incurring in some error? Yes, but only transiently

EXAMPLE

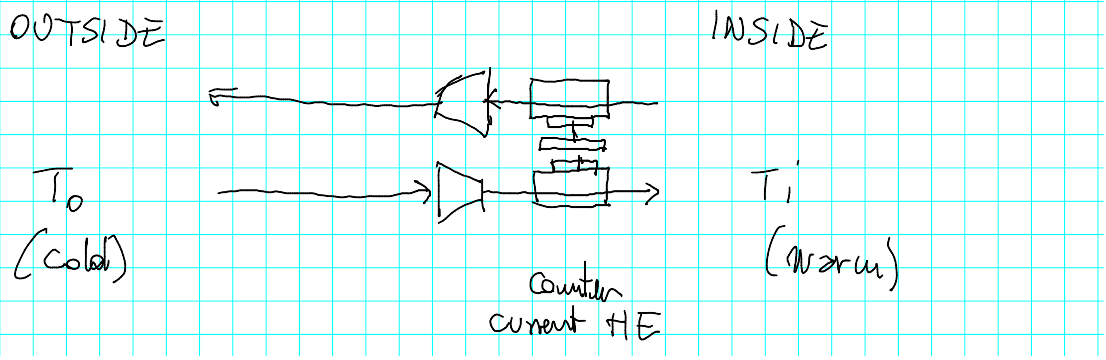


estimated consumption →

→ REAL consumption goes like this

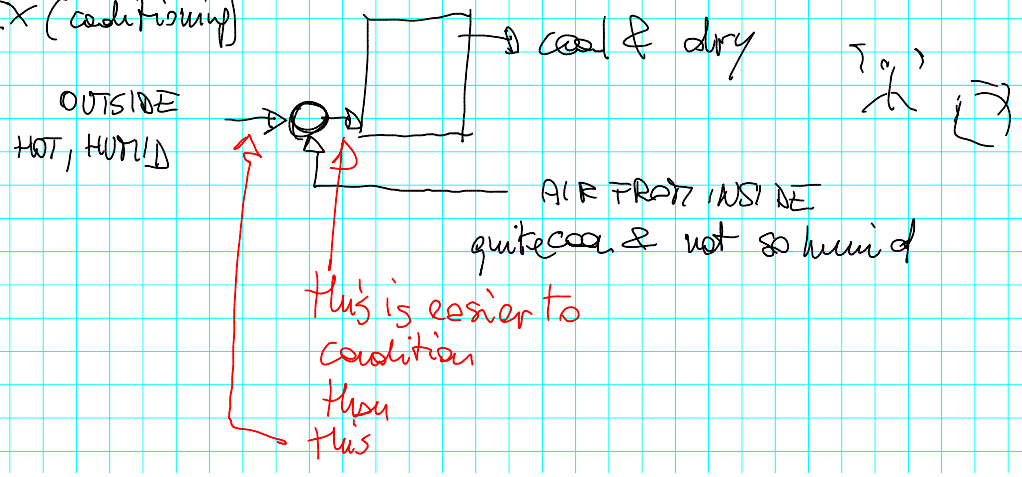
Note: in general air renovation implies some heat recovery

Example (winter, heating)



Note 2: some mixing can occur to lighten the burden on AHUs

EX (conditioning)



FF compensation of outside T for control of interest T