Peer Review- Group 730

Disclaimer:

We understand that the project is somewhat specified upon receipt, therefore you should probably disregard the novelty and significance to some extent, as you are not too much in control of what the project should contain regarding the concepts used.

Novelty:

Searching through Aub three articles appear that deal with a similar topic. Namely,

- "Energy efficient control of HVAC systems with ice cold thermal energy storage"

Link: https://journals-sagepub-com.zorac.aub.aau.dk/doi/pdf/10.1177/014362449701800105

- "HVAC with thermal energy storage: Optimal design and optimal scheduling".

Link: https://www-sciencedirect-com.zorac.aub.aau.dk/science/article/pii/S0959152414000328

- "Energetic, Cost, and Comfort Performance of a Nearly-Zero Energy Building Including Rule-Based Control of Four Sources of Energy Flexibility"

Link: https://www.mdpi.com/2075-5309/8/12/172

What we found:

The first two found that with TES, it was possible to shift peak loads periods. The latter also concluding that this enables lowering of annual cost. However, none of these two have: Hot storage for heating, both use ice for cooling. Communication setup for remote control. Models for heating TES system, an RBC controller and, a Self-updating electricity prices.

The third article uses RBC to control the temperature of floor heating (FH) as well as domestic house water (DHW), as well as electricity. They also have an extra power source.

So in general the idea is not novel, but it is still interesting.

Correctness:

Most of the equations seem to be correct. However, some numbers are missing in order to replicate the exact results (water conductance, wall conductance)

Significance:

While this is an interesting idea, the project doesn't really seem to use any new (or less established) control scheme in a new situation or context.

Overall assessment:

Interesting and well written. The idea behind the control strategy is well presented, and easy to understand as a reader – you quickly understand what the goal of the paper is. This also makes it easy to read the graphs and results chapter. The most important result, which we would say is something showing how the system accumulates energy while price is low, and uses accumulated energy when price is high, is not present yet though.

Nice work!

General comments:

GC1. Maybe too little Network compared to the curriculum? As far as we can see you don't really mention any network topology or how you manage stuff over the network. Although we have no idea whether it is that relevant for you guys.

GC2. Maybe too little on the control part as well. You explain the control strategy nicely, but you go very light over the actual design. There is no lag-controller design, only short PI using bode-plot, however none of the transfer function, anti-windup or the linearization is shown. This leaves you short in our opinion on the use of control theory.

GC3. Use more subsections in the modelling part for each of the models. Makes it easier to read.

GC4. Regarding the IMRaD structure, we noted that the results contain some extra methods that you use to obtain the results, least squares and Nusselt. Furthermore, you compare and discuss the results in the section as well, which should rather go in the discussion or conclusion.

Specific comments:

SC1. Would Eq. (8) not be the estimated conductance $\hat{G}_{hc,t}$? (we think there should be a hat on G). We think this because this is how it is presented in **fig. 6.**

SC2. On figure 2 "O_{valve}" is marked. This is confusing as it is not mentioned until the end of control "Lastly, the RBC uses the opening degree of the valve in charging mode to determine the compressor speed."

SC3. In control you use Nusselt's number. It is not made clear that the constants "$0{,}023$" and "$P_r^{0,4}$" are combined with Reynolds proportionality to flow into one constant "c_i".

SC4. On **fig. 4** the valve is moved compared to **fig 1** and **5**. Maybe it could be mentioned somewhere in the text why this is the case.

SC5. **Equation 1** seems to include c_w in both denominator and numerator which would cancel it out from the equation. The one from the numerator seems to be wrong by looking at the heat capacity equation.

SC6. **Figure 3** can be moved to its subsection with the H flag (\begin{figure}**[H]**) as it is presented before it is used, which interrupts the flow.