Report of TP session 1

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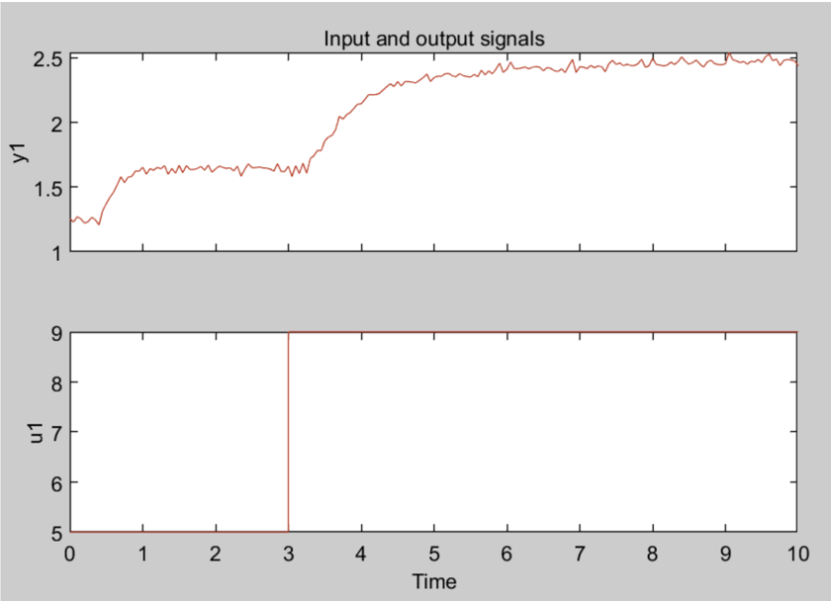
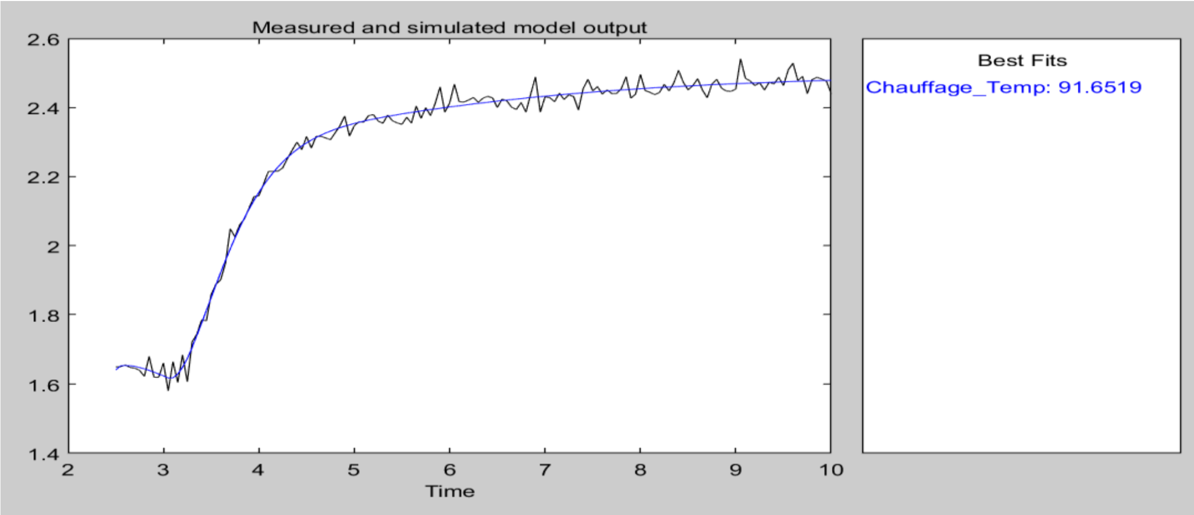
- The model between **chauffage** and **temperature**

In this part, we add a setup (Step Time = 3s; Initial Value = 0; Final Value = 4; Te = 0.05s) as a part of the input of the chauffage. After the simulation, we get the temperature-time and chauffage-time plots as shown below.

It is easy to find that the temperature increases with the argumentation of the Step function in the input. Then we refer to the System-Identification Toolbox to identify the model.
We import the data shown below and cut it from **2.5s to 10s**.



Then we use the transfer function model to identify:
We set **3 poles and 1 zero with time delay** and achieved the best accuracy we have tried: ***91.6519%***



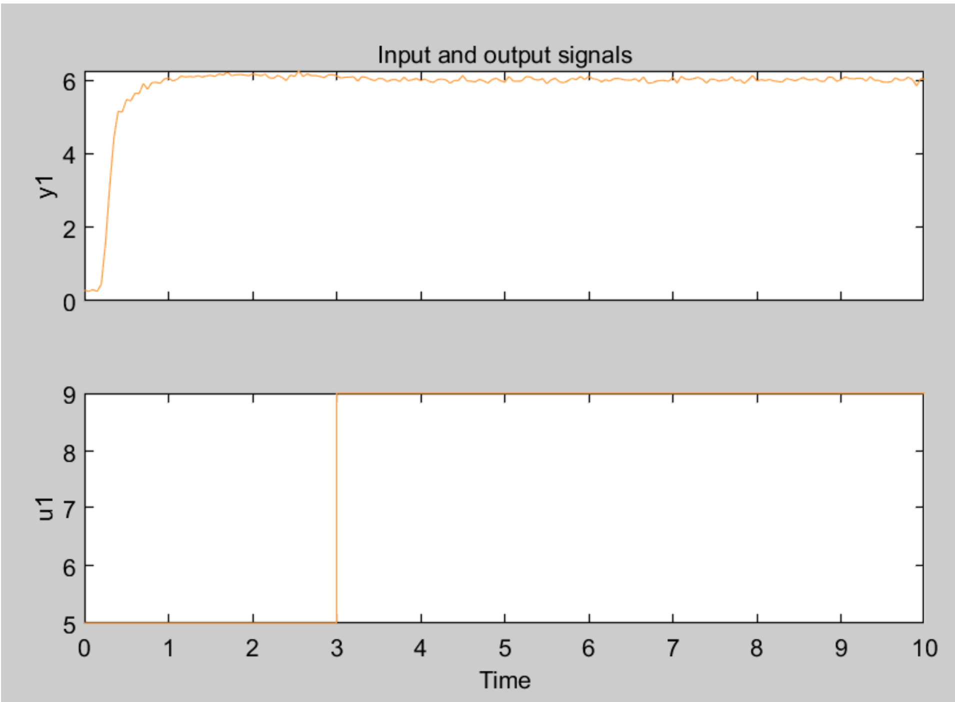
The Model details are shown below:

```
Chauffage_Temp =

  From input "u1" to output "y1":
                              1.347 (+/- 0.1987) s + 0.8525 (+/- 0.3279)
  exp(-0.05*s) * ----------------------------------------------------------------------
                 s^3 + 5.102 (+/- 0.5127) s^2 + 9.509 (+/- 1.137) s + 3.071 (+/- 1.204)

Name: Chauffage_Temp
Continuous-time identified transfer function.

Parameterization:
   Number of poles: 3   Number of zeros: 1
   Number of free coefficients: 5
   Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Termination condition: Maximum number of iterations reached..
Number of iterations: 20, Number of function evaluations: 104

Estimated using TFEST on time domain data "Chau_Teme".
Fit to estimation data: 91.65% (stability enforced)
FPE: 0.0005749, MSE: 0.0005171
More information in model's "Report" property.
```

- The model between **chauffage** and debit **massique**

From the previous simulation we found that:

The debit massique has nothing to do with the change of the chauffage when a setup input is imported, which is clearly shown in the graph below.

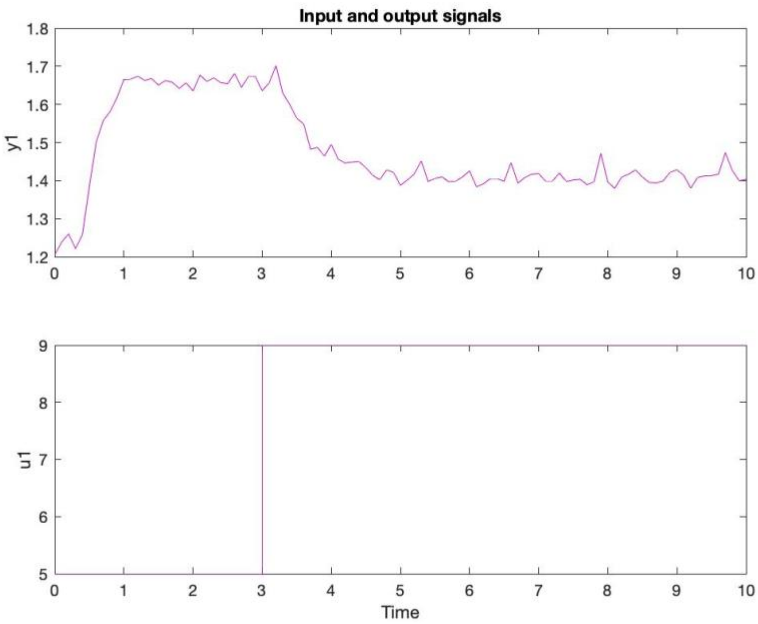


Therefore, it is reasonable to assume that the model between chauffage and debit massique is 0.

The model between **ventilation** and **temperature**

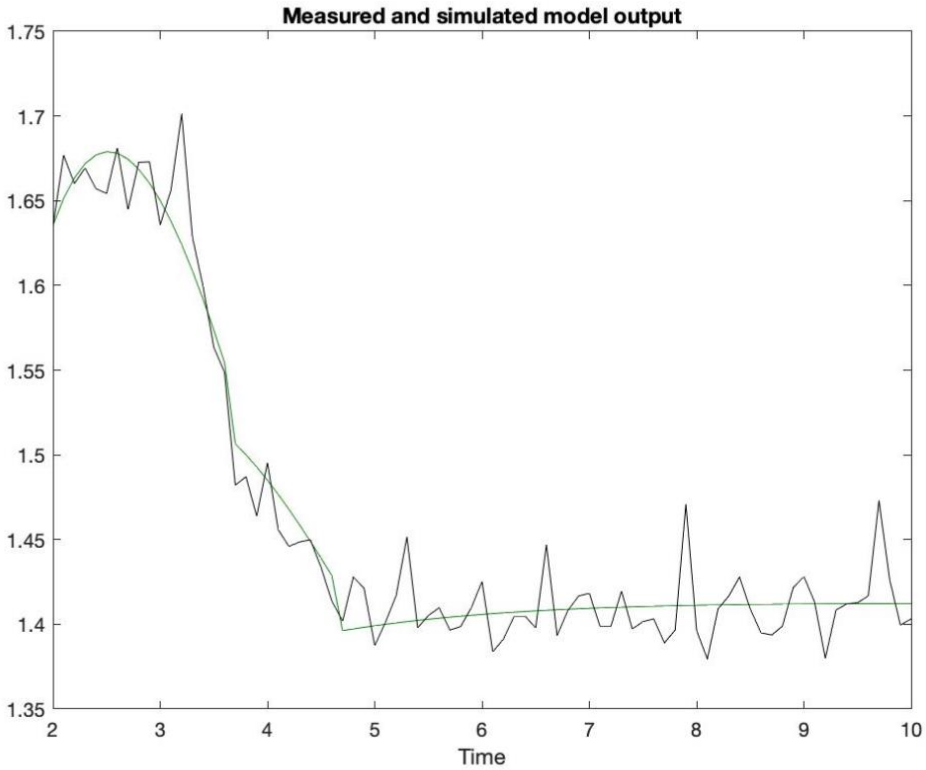
In this part, we set the sampling time as 0.1s to maximize the accuracy. And the other paramters for simulation is the same.

The ventilation-time and temperature-time plots are shown below:



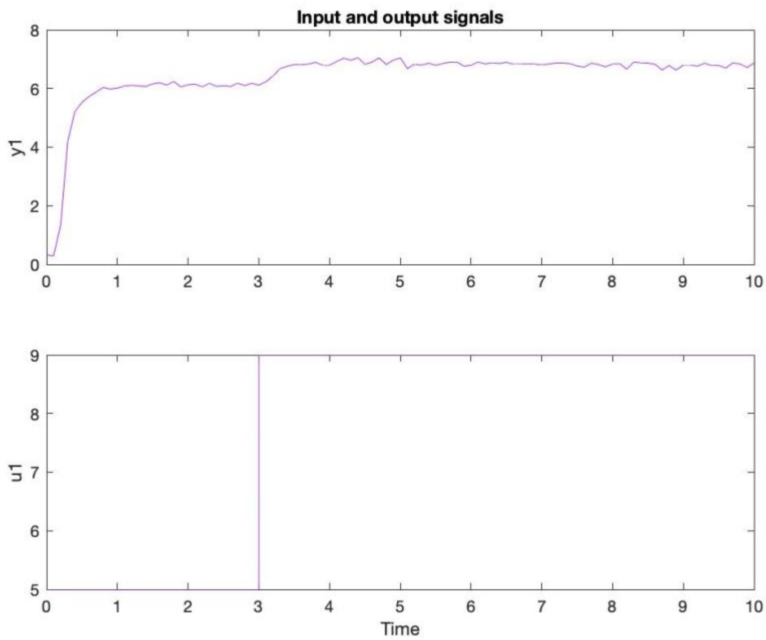
It's obvious that the temperature decreases with the increase of the input ventilation. We use the system-identification toolbox to identify the model:
We cut it from 2s to 10s and set 2 poles and 2 zeros points and realize an accuracy of **79.16%**.

```
vent_temp =

  From input "u1" to output "y1":
                -0.005487 s^2 + 0.02488 s + 0.0264
  exp(-1.7*s) * ----------------------------------
                     s^2 + 0.7964 s + 0.1684

Name: vent_temp
Continuous-time identified transfer function.

Parameterization:
   Number of poles: 2   Number of zeros: 2
   Number of free coefficients: 5
   Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using TFEST on time domain data "vent_tempe".
Fit to estimation data: 79.16% (stability enforced)
FPE: 0.0004888, MSE: 0.000411
```



- ## The model between **ventilation** and **débit massique**

Similarly, we find that the debit massique increases with the step increase of the ventilation as shown below:



In this case, we cut it from 3s to 11s and set 3 poles and 1 zero point and achieve an accuracy of **62.74%.**

```
vent_mass =

  From input "u1" to output "y1":
                      1.053 s + 1.155
  exp(-0.1*s) * ---------------------------------
                s^3 + 1.942 s^2 + 6.112 s + 1.517

Name: vent_mass
Continuous-time identified transfer function.

Parameterization:
   Number of poles: 3   Number of zeros: 1
   Number of free coefficients: 5
   Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using TFEST on time domain data "vent_masse".
Fit to estimation data: 62.74% (stability enforced)
FPE: 0.01188, MSE: 0.009746
```