```
>> househeat
>> T_s=60;                        %% second
timeUnit_1hour=3600/T_s;
timeUnit_1day=timeUnit_1hour*24;
timeUnit_1week=7*timeUnit_1day;
>> timeUnit_1week*3.5

ans =

       35280

>> ans/3600

ans =

    9.8000

>> timeUnit_1week*3.5/timeUnit_1day

ans =

   24.5000

>> 38*timeUnit_1day

ans =

       54720

>> ans/timeUnit_1week

ans =

    5.4286

>> timeUnit_1week*7/timeUnit_1day

ans =

    49

>> timeUnit_1week*6/timeUnit_1day

ans =

    42

>> timeUnit_1week*5,5/timeUnit_1day
```

```
ans =

       50400


ans =

    0.0035

>> timeUnit_1week*5.5/timeUnit_1day

ans =

   38.5000

>> 60*timeUnit_1day/timeUnit_1week

ans =

    8.5714

>> 61*timeUnit_1day/timeUnit_1week

ans =

    8.7143

>> 62*timeUnit_1day/timeUnit_1week

ans =

    8.8571

>> 63*timeUnit_1day/timeUnit_1week

ans =

     9

-->Converting model to discrete time.
-->Assuming output disturbance added to measured output channel #1 is ↙
integrated white noise.
-->The "Model.Noise" property of the "mpc" object is empty. Assuming white ↙
noise on each measured output channel.
>> load('mpc_floor_radiator.mat')
>> mpc_floor_radiator.ManipulatedVariables(1).RateMin = 0;
>> mpc_floor_radiator.ManipulatedVariables(2).RateMin = 0;
```

```
>> mpc_floor_radiator.ManipulatedVariables(1).RateMax = 0;
>> mpc_floor_radiator.ManipulatedVariables(2).RateMax = 0;
Warning: Undefined function or variable
'househeat_data_szakdoga'.
Warning: Workspace for block diagram 'Radiator'
was not loaded because an error occurred while
loading MATLAB code: 'househeat_data_szakdoga'

tf12 =

  From input "u1" to output "y1":
     0.0001241 (+/- 1.292e-05) s + 3.233e-09 (+/- 5.782e-08)
  ---------------------------------------------------------
  s^2 + 0.0002904 (+/- 0.0003967) s + 2.236e-08 (+/- 1.261e-07)

  From input "u2" to output "y1":
                  9.328e-09 (+/- 1.826e-08)
  ---------------------------------------------------------
  s^2 + 2.155e-05 (+/- 4e-05) s + 4.601e-09 (+/- 1.074e-09)

Name: tf12
Continuous-time identified transfer function.

Parameterization:
   Number of poles: [2 2]   Number of zeros: [1 0]
   Number of free coefficients: 7
   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: 69

Estimated using TFEST on time domain data "radiator_unittest_full".
Fit to estimation data: 75.78% (stability enforced)
FPE: 83.38, MSE: 79.25
More information in model's "Report" property.
Warning: While saving an object of class 'matlabshared.scopes. ↙
UnifiedScope':
Method 'saveobj' is not defined for class 'matlabshared.scopes. ↙
UnifiedScope' or is removed from MATLAB's
search path.
> In matlab.graphics.internal.figfile.FigFile/write (line 32)
  In savefig (line 84)
  In saveasfig (line 6)
  In saveas (line 140)
  In filemenufcn>localSaveExportHelper (line 216)
  In filemenufcn>localSaveExport (line 344)
```

```
  In filemenufcn (line 56)
  In filemenufcn>localSave (line 186)
  In filemenufcn (line 54)
Warning: While saving an object of class 'matlabshared.scopes. ↙
UnifiedScope':
Method 'saveobj' is not defined for class 'matlabshared.scopes. ↙
UnifiedScope' or is removed from MATLAB's
search path.
> In matlab.graphics.internal.figfile.FigFile/write (line 32)
  In savefig (line 84)
  In saveasfig (line 6)
  In saveas (line 140)
  In filemenufcn>localSaveExportHelper (line 216)
  In filemenufcn>localSaveExport (line 344)
  In filemenufcn (line 56)
  In filemenufcn>localSave (line 186)
  In filemenufcn (line 54)
Warning: Figure is saved in C:\Users\Gyulai
László\Documents\thesis\model\components\radiator_unittest\unittest_heat_in ↙
_out.fig. Saving graphics handle
variables can cause the creation of very large files. To save graphics ↙
figures, use savefig.
> In matlab.graphics.internal.figfile.FigFile/write (line 32)
  In savefig (line 84)
  In saveasfig (line 6)
  In saveas (line 140)
  In filemenufcn>localSaveExportHelper (line 216)
  In filemenufcn>localSaveExport (line 344)
  In filemenufcn (line 56)
  In filemenufcn>localSave (line 186)
  In filemenufcn (line 54)
Warning: While saving an object of class 'matlabshared.scopes. ↙
UnifiedScope':
Method 'saveobj' is not defined for class 'matlabshared.scopes. ↙
UnifiedScope' or is removed from MATLAB's
search path.
> In matlab.graphics.internal.figfile.FigFile/write (line 32)
  In savefig (line 84)
  In saveasfig (line 6)
  In saveas (line 140)
  In filemenufcn>localSaveExportHelper (line 216)
  In filemenufcn>localSaveExport (line 344)
  In filemenufcn (line 56)
  In filemenufcn>localSave (line 186)
  In filemenufcn (line 54)
Warning: While saving an object of class 'matlabshared.scopes. ↙
UnifiedScope':
Method 'saveobj' is not defined for class 'matlabshared.scopes. ↙
```

```
UnifiedScope' or is removed from MATLAB's
search path.
> In matlab.graphics.internal.figfile.FigFile/write (line 32)
  In savefig (line 84)
  In saveasfig (line 6)
  In saveas (line 140)
  In filemenufcn>localSaveExportHelper (line 216)
  In filemenufcn>localSaveExport (line 344)
  In filemenufcn (line 56)
  In filemenufcn>localSave (line 186)
  In filemenufcn (line 54)
Warning: Figure is saved in C:\Users\Gyulai
László\Documents\thesis\model\components\radiator_unittest\unittest_heat_in ↙
_out.fig. Saving graphics handle
variables can cause the creation of very large files. To save graphics ↙
figures, use savefig.
> In matlab.graphics.internal.figfile.FigFile/write (line 32)
  In savefig (line 84)
  In saveasfig (line 6)
  In saveas (line 140)
  In filemenufcn>localSaveExportHelper (line 216)
  In filemenufcn>localSaveExport (line 344)
  In filemenufcn (line 56)
  In filemenufcn>localSave (line 186)
  In filemenufcn (line 54)
>> tf(1; [1 0])
 tf(1; [1 0])
     ↑
Error: Unbalanced or unexpected parenthesis or
bracket.

>> tf(1, [1 0])

ans =

  1
  -
  s

Continuous-time transfer function.

>> tf(1)

ans =

  1

Static gain.
```

```
>> a=tf(1, [1 0])

a =

  1
  -
  s

Continuous-time transfer function.

>> b=tf(1)

b =

  1

Static gain.

>> c=series
>> tf({1 1})
Error using tf (line 287)
In the "tf(M)" command, M must be a numeric
array.

>> tf({1 1},{1 1})

ans =

  From input 1 to output:
  1

  From input 2 to output:
  1

Static gain.

>> mia=tf({1 1},{1 1})

mia =

  From input 1 to output:
  1

  From input 2 to output:
  1

Static gain.
```

```
>> step(mia)
>> mia

mia =

  From input 1 to output:
  1

  From input 2 to output:
  1

Static gain.

>> sum=mia

sum =

  From input 1 to output:
  1

  From input 2 to output:
  1

Static gain.

>> radiator_unittest_heat_in_out

radiator_unittest_heat_in_out =

  From input "u1" to output "y1":
    -0.000207 s + 2.584e-06
  ---------------------------
  s^2 + 0.01772 s + 6.636e-06

Name: tf13
Continuous-time identified transfer function.

Parameterization:
   Number of poles: 2   Number of zeros: 1
   Number of free coefficients: 4
   Use "tfdata", "getpvec", "getcov" for parameters and their ↙
uncertainties.

Status:
Estimated using TFEST on time domain data "radiator_unittest".
Fit to estimation data: 96.58% (stability enforced)
FPE: 0.7653, MSE: 0.7443
```

```
>> step(radiator_unittest_heat_in_out)
>> series(radiator_unittest_heat_in_out,sum,1,1)

ans =

  From input "u1" to output:
    -0.000207 s + 2.584e-06
  ---------------------------
  s^2 + 0.01772 s + 6.636e-06

Continuous-time transfer function.

>> heatsum=series(radiator_unittest_heat_in_out,sum,1,1)

heatsum =

  From input "u1" to output:
    -0.000207 s + 2.584e-06
  ---------------------------
  s^2 + 0.01772 s + 6.636e-06

Continuous-time transfer function.

>> sum

sum =

  From input 1 to output:
  1

  From input 2 to output:
  1

Static gain.

>> heatins=append(radiator_unittest_heat_in_out,tf(1,1))

heatins =

  From input "u1" to output...
          -0.000207 s + 2.584e-06
   y1:  ---------------------------
        s^2 + 0.01772 s + 6.636e-06

   2:  0

  From input 2 to output...
   y1:  0
```

```
   2:  1

Continuous-time transfer function.

>> heatsum=series(heatins,sum(
 heatsum=series(heatins,sum(
                            ↑
Error: Expression or statement is incorrect--possibly unbalanced (, {, or ↙
[.

Did you mean:
>> heatsum=series(heatins,sum)

heatsum =

  From input "u1" to output:
    -0.000207 s + 2.584e-06
  ---------------------------
  s^2 + 0.01772 s + 6.636e-06

  From input 2 to output:
  1

Continuous-time transfer function.

>> tf(1,[1 0])
>> heat_temp=series(heatsum, tf(1,[1 0]))

heat_temp =

  From input "u1" to output:
      -0.000207 s + 2.584e-06
  -------------------------------
  s^3 + 0.01772 s^2 + 6.636e-06 s

  From input 2 to output:
  1
  -
  s

Continuous-time transfer function.

>>
```