

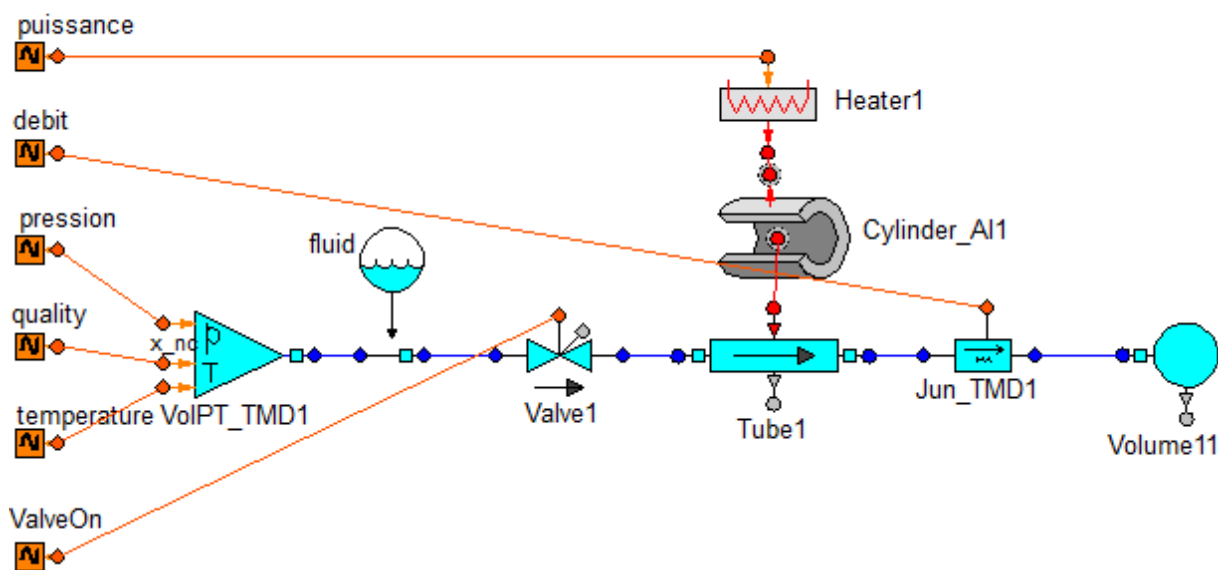
## Example of heating of a tube with ESPSS EcosimPro

### Summary

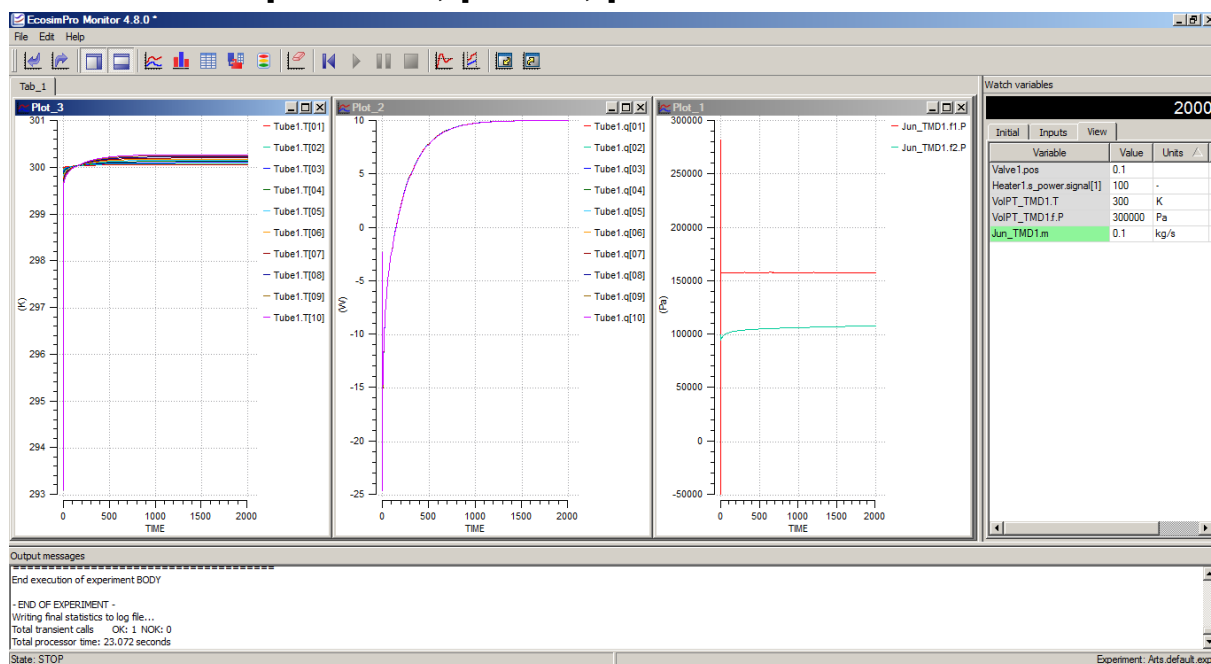
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## Model of a simple heating of a fluid tube :

### Discretisation en 10 éléments



## Results: temperature, power, pressure



## Details of the model

```
-- Generated automatically by -
EcosimPro - 4.8.0
USE CONTROL VERSION "3.0"
USE FLUID_FLOW_1D VERSION "2.0"
USE THERMAL VERSION
"3.2" COMPONENT Arts
```

### TOPOLOGY

```
CONTROL.AnalogSource(
n_out = 1) ValveOn(
source = Source_Constant,
Amp = 0.1, -- Non default value.
Tstart = 0,
Offset = 0,
Phase = 0,
Period = 10,
pulseWidth = 0.001,
rampDuration = 10,
tabmethod = LinearInterpWithEvents,
timeTable = { { 0,10} ,{ 0,0} })
CONTROL.AnalogSource(
n_out = 1) quality(
source = Source_Constant,
Amp = 0, -- Non default value.
Tstart = 0,
Offset = 0,
Phase = 0,
Period = 10,
pulseWidth = 0.001,
rampDuration = 10,
tabmethod = LinearInterpWithEvents,
timeTable = { { 0,10} ,{ 0,0} })
CONTROL.AnalogSource(
n_out = 1) temperature(
source = Source_Constant,
Amp = 300, -- Non default value.
Tstart = 0,
Offset = 0,
Phase = 0,
Period = 10,
pulseWidth = 0.001,
rampDuration = 10,
tabmethod = LinearInterpWithEvents,
timeTable = { { 0,10} ,{ 0,0} })
CONTROL.AnalogSource(
n_out = 1) pression(
source = Source_Constant,
Amp = 3E5, -- Non default value.
Tstart = 0,
Offset = 0,
Phase = 0,
Period = 10,
pulseWidth = 0.001,
rampDuration = 10,
tabmethod = LinearInterpWithEvents,
timeTable = { { 0,10} ,{ 0,0} })
CONTROL.AnalogSource(
n_out = 1) puissance(
source = Source_Constant,
Amp = 100, -- Non default value.
Tstart = 0,
Offset = 0,
Phase = 0,
Period = 10,
pulseWidth = 0.001,
rampDuration = 10,
tabmethod = LinearInterpWithEvents,
```

```
timeTable = { { 0,10} ,{ 0,0} })
FLUID_FLOW_1D.Tube(
nodes = 10, -- Non default value.
n_bends = 1,
scheme = centred,
case = predefined,
CAV_DAMP = FALSE) Tube1(
num = 1,
init_option = INIT_PT,
P_o = 100000,
T_o = 293.15,
x_o = 0,
rho_o = 1,
x_nco = 0,
m_o = 0,
rug = 5e-005,
k_f = 1,
k_d = 1,
fld_add = 0,
alpha_bend = {0},
R_bend = {1},
ht_option = HT_tube,
hc_dat = 1,
entropy_fix = no_fix,
entropy_fix_multiplier = 4,
integration_rule = midpoint,
dp_correction = FALSE,
limiter = VanAlbada,
preconditioner = unprecond,
reconstructed_variables = primitive,
central_reconstruction = TRUE,
source_upwind_smoothing = 0,
L = 1,
D = 0.01,
D_vs_L = { { 0,0.5,1} ,{ 1,1,1} },
dx_vs_L = { { 0,0.5,1} ,{ 1,1,1} })
THERMAL.Cylinder_AI(
nz = 10, -- Non default value.
nr = 3) Cylinder_AI1(
L = 1,
Di = 0.1,
Do = 0.12,
num = 1,
mat = None,
k = 0.1,
rho = 1000,
cp = 500,
TemperatureDependence = TRUE,
init_mode = Constant_Temp,
To = 290,
To_linear = { 290,290},
To_table = { { 0,1} ,{ 290,290} })
THERMAL.Heater(
n = 10 -- Non default value.
) Heater1
FLUID_FLOW_1D.WorkingFluid fluid(
fluid = Real_H2O, -- Non default value.
fluid_nc = PfGas_N2 -- Non default value.
)
FLUID_FLOW_1D.VolPT_TMD
VolPT_TMD1
FLUID_FLOW_1D.Valve Valve1(
x_jun = 0,
y_jun = 0,
z_jun = 0,
Ao = 7e-005,
```

```
zetaf = 0,
zetaab = 0,
m_o = 0,
Gcr_exact = FALSE,
tao = 0.0001)
FLUID_FLOW_1D.Volume1
Volume11(
init_option = INIT_PT,
P_o = 100000,
T_o = 293.15,
x_o = 0,
rho_o = 1,
x_nco = 1, -- Non default value.
Vo = 10, -- Non default value.
L = 0,
Pw = 0,
z_bottom = 0,
dV_VdP = 4e-009,
P_ref = 100000,
iangle = {0},
iside = {1})
FLUID_FLOW_1D.Jun_TMD
Jun_TMD1(
x_jun = 0,
y_jun = 0,
z_jun = 0,
tao = 0.0001)
CONTROL.AnalogSource(
n_out = 1) debit(
source = Source_Constant,
Amp = 0.1, -- Non default value.
Tstart = 0,
Offset = 0,
Phase = 0,
Period = 10,
pulseWidth = 0.001,
rampDuration = 10,
tabmethod = LinearInterpWithEvents,
timeTable = { { 0,10} ,{ 0,0} })
CONNECT fluid.f2 TO VolPT_TMD1.f
CONNECT Valve1.f1 TO fluid.f1
CONNECT Valve1.f2 TO Tube1.f1
CONNECT Heater1.tp_out TO
Cylinder_AI1.tpr_out
CONNECT Cylinder_AI1.tpr_in TO
Tube1.tp_in
CONNECT Jun_TMD1.f1 TO Tube1.f2
CONNECT Jun_TMD1.f2 TO
Volume11.f[1]
CONNECT debit.s_out TO
Jun_TMD1.s_massflow
CONNECT puissance.s_out TO
Heater1.s_power
CONNECT pression.s_out TO
VolPT_TMD1.s_pres
CONNECT quality.s_out TO
VolPT_TMD1.s_xNonCond
CONNECT temperature.s_out TO
VolPT_TMD1.s_temp
CONNECT ValveOn.s_out TO
Valve1.s_pos
END COMPONENT
```

## Details of the experiment used to get the results

```
EXPERIMENT exp1 ON Arts.default
DECLS
INIT
-- initial values for state variables
BOUNDS
-- Set equations for boundaries: boundVar = f(TIME,...)
FLUID_FLOW_1D.Damp = 0.3
FLUID_FLOW_1D.GRAV = 9.806
FLUID_FLOW_1D.GRAVx = 0
```

```
FLUID_FLOW_1D.GRAVy = 0
FLUID_FLOW_1D.Re_lam = 200
BODY
-- report results in file reportAll.rpt
REPORT_TABLE("reportAll.rpt", "**")
-- integrate the model 15 seconds and obtain results
every 0.1 seconds
REL_ERROR=1E-5
ABS_ERROR=REL_ERROR
```

```
REPORT_MODE=IS_STEP --
REPORT_MODE=IS_EVENT,IS_CINT,IS_STEP
TIME = 0
TSTOP = 2000
CINT = 10
INTEG()
END EXPERIMENT
```