Software Information

- Please check, whether your inputs, the equations applied and the charactersitics are displayed correctly.
- You are welcome to send your feedback via `https://github.com/oemof/tespy/issues`.
- LaTeXpackages required are:
  - graphicx
  - float
  - hyperref
  - booktabs
  - amsmath
  - units
  - cleveref
- To supress these messages, call the model documentation with the keyword draft=False.

TESPy Version:	0.4.0 - dev
Commit:	d918f10d@feature/self_documenting_models
CoolProp version:	6.4.0
Python version:	3.8.0 (default, Oct 28 2019, 16:14:01) [GCC 8.3.0]

1 Connections in offdesign mode

1.1 Specified connection parameters

label	m in kg/s (1)	p in bar (2)	T in °C (3)
cycle closer:out1_turbine inlet valve:in1	6.430	110.000	550.000
source_cw:out1_condenser:in2	-	10.000	60.000
condenser:out2_sink_cw:in1	-	-	110.000

Table 1: Specified connection parameters

1.2 Equations applied

$$0 = \dot{m} - \dot{m}_{\text{spec}} \tag{1}$$

$$0 = p - p_{\text{spec}} \tag{2}$$

$$0 = T\left(p, h\right) - T_{\text{spec}} \tag{3}$$

1.3 Specified fluids

label	water (4)
cycle closer:out1_turbine inlet valve:in1	1.000
source_cw:out1_condenser:in2	1.000

Table 2: Specified fluids

1.4 Equations applied

$$0 = x_{\text{water}} - x_{\text{water,spec}} \tag{4}$$

2 Components in offdesign mode

2.1 Components of type CycleCloser

2.1.1 Mandatory constraints

$$0 = p_{\text{in},i} - p_{\text{out},i} \; \forall i \in [1] \tag{5}$$

$$0 = h_{\text{in},i} - h_{\text{out},i} \; \forall i \in [1] \tag{6}$$

2.2 Components of type Valve

2.2.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1] \tag{7}$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{8}$$

$$0 = h_{\text{in},i} - h_{\text{out},i} \; \forall i \in [1] \tag{9}$$

2.3 Components of type Turbine

2.3.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1] \tag{10}$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{11}$$

2.3.2 Inputs specified

label	eta_s_char (12)	cone (13)
high pressure turbine	True	True
low pressure turbine	True	True

Table 3: Parameters of components of type Turbine

2.3.3 Equations applied

$$0 = -\left(h_{\text{out}} - h_{\text{in}}\right) + \eta_{\text{s,design}} \cdot f\left(X\right) \cdot \left(h_{\text{out,s}} - h_{\text{in}}\right) \tag{12}$$

$$0 = \frac{\dot{m}_{\text{in,design}} \cdot p_{\text{in}}}{p_{\text{in,design}}} \cdot \sqrt{\frac{p_{\text{in,design}} \cdot v_{\text{in}}}{p_{\text{in}} \cdot v_{\text{in,design}}} \cdot \frac{1 - \left(\frac{p_{\text{out}}}{p_{\text{in}}}\right)^2}{1 - \left(\frac{p_{\text{out,design}}}{p_{\text{in,design}}}\right)^2}} - \dot{m}_{\text{in}} \tag{13}$$

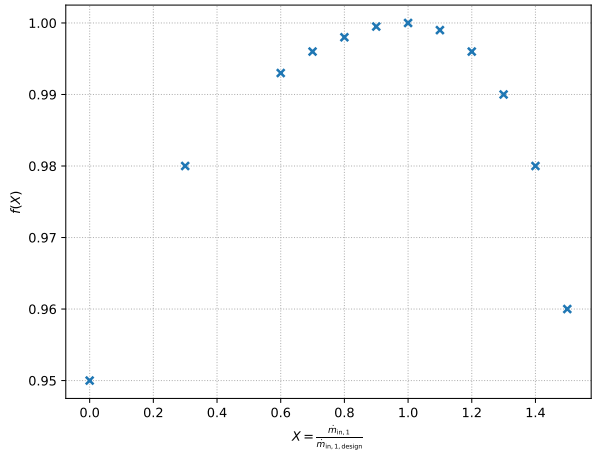

Figure 1: Characteristics of high pressure turbine (eq. 12)

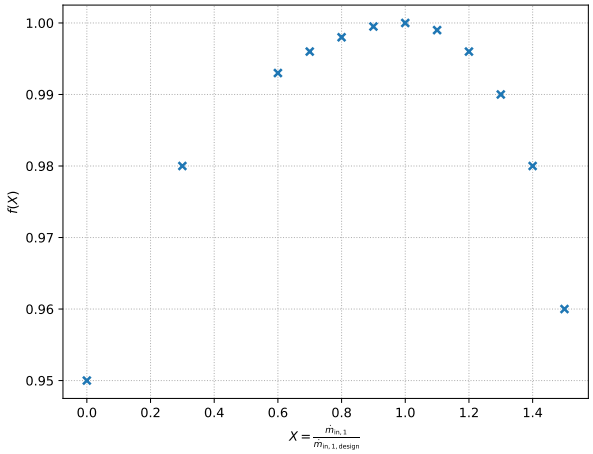

Figure 2: Characteristics of low pressure turbine (eq. 12)

2.4 Components of type Splitter

2.4.1 Mandatory constraints

$$0 = \sum \dot{m}_{\text{in},i} - \sum \dot{m}_{\text{out},j} \; \forall i \in \text{inlets}, \forall j \in \text{outlets} \tag{14}$$

$$0 = x_{fl,\text{in}} - x_{fl,\text{out},j} \; \forall fl \in \text{network fluids}, \forall j \in \text{outlets} \tag{15}$$

$$0 = h_{in} - h_{\text{out},j} \; \forall j \in \text{outlets} \tag{16}$$

$$
\begin{aligned}
0 &= p_{\text{in},1} - p_{\text{in},i} \; \forall i \in \text{inlets} \setminus \{1\} \\
0 &= p_{\text{in},1} - p_{\text{out},j} \; \forall j \in \text{outlets}
\end{aligned}
\tag{17}
$$

2.5 Components of type Condenser

2.5.1 Mandatory constraints

$$
0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1, 2] \tag{18}
$$

$$
0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1, 2] \tag{19}
$$

$$
0 = \dot{m}_{\text{in},1} \cdot (h_{\text{out},1} - h_{\text{in},1}) + \dot{m}_{\text{in},2} \cdot (h_{\text{out},2} - h_{\text{in},2}) \tag{20}
$$

2.5.2 Inputs specified

label	pr1 (21)	zeta2 (22)	kA_char (23)	subcooling (24)
preheater	1.000	3217709.140	True	True
condenser	1.000	3372.535	True	True

Table 4: Parameters of components of type Condenser

2.5.3 Equations applied

$$
0 = p_{\text{in},1} \cdot pr1 - p_{\text{out},1} \tag{21}
$$

$$
0 = \begin{cases}
p_{\text{in},2} - p_{\text{out},2} & |\dot{m}_{\text{in},2}| < 0.0001 \, \text{kg/s} \\
\frac{\zeta}{D^4} - \frac{(p_{\text{in},2} - p_{\text{out},2}) \cdot \pi^2}{8 \cdot \dot{m}_{\text{in},2} \cdot |\dot{m}_{\text{in},2}| \cdot \frac{v_{\text{in},2} + v_{\text{out},2}}{2}} & |\dot{m}_{\text{in},2}| \geq 0.0001 \, \text{kg/s}
\end{cases} \tag{22}
$$

$$
\begin{aligned}
0 =& \dot{m}_{\text{in},1} \cdot (h_{\text{out},1} - h_{\text{in},1}) \\
&+ kA_{\text{design}} \cdot f_{\text{kA}} \cdot \frac{T_{\text{out},1} - T_{\text{in},2} - T_{\text{sat}}(p_{\text{in},1}) + T_{\text{out},2}}{\ln \frac{T_{\text{out},1} - T_{\text{in},2}}{T_{\text{sat}}(p_{\text{in},1}) - T_{\text{out},2}}} \\
f_{\text{kA}} =& \frac{2}{\frac{1}{f(X_2)} + \frac{1}{f(X_2)}}
\end{aligned}
\tag{23}
$$

$$
0 = h_{\text{out},1} - h\left(p_{\text{out},1}, x = 0\right) \tag{24}
$$

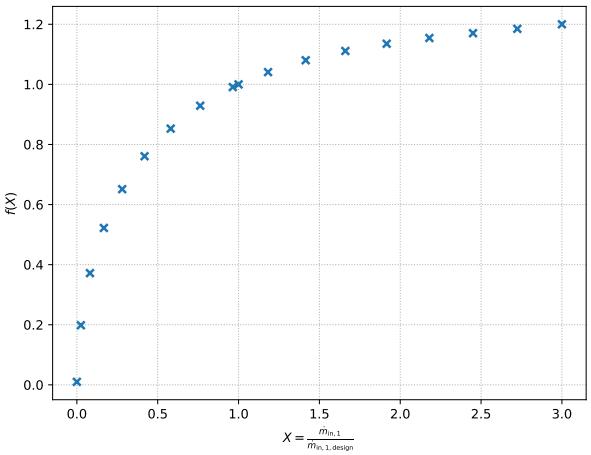

Figure 3: Characteristics of preheater (eq. 23)

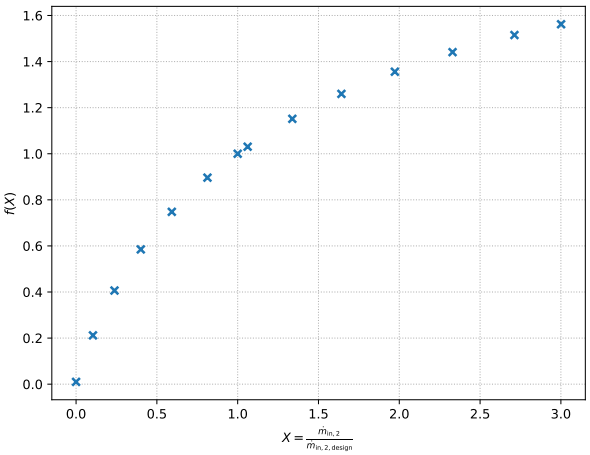

Figure 4: Characteristics of preheater (eq. 23)

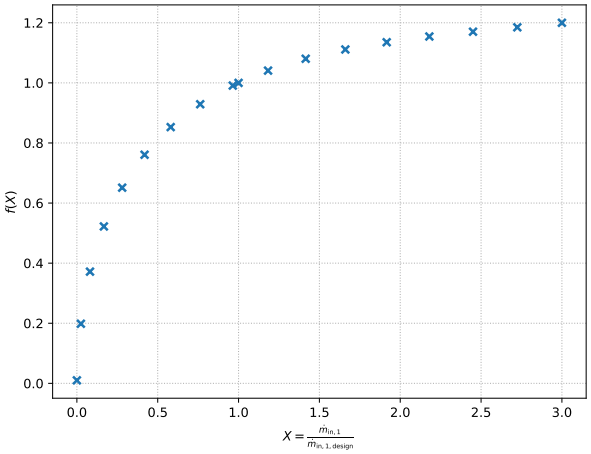

Figure 5: Characteristics of condenser (eq. 23)

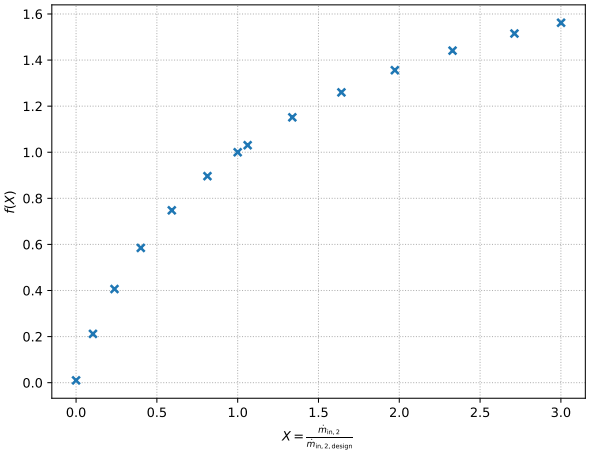

Figure 6: Characteristics of condenser (eq. 23)

2.6 Components of type Merge

2.6.1 Mandatory constraints

$$0 = \sum \dot{m}_{\text{in},i} - \sum \dot{m}_{\text{out},j} \; \forall i \in \text{inlets}, \forall j \in \text{outlets} \tag{25}$$

$$0 = \sum_i \dot{m}_{\text{in},i} \cdot x_{fl,\text{in},i} - \dot{m}_{\text{out}} \cdot x_{fl,\text{out}} \; \forall fl \in \text{network fluids}, \forall i \in \text{inlets} \tag{26}$$

$$0 = \sum_i (\dot{m}_{\text{in},i} \cdot h_{\text{in},i}) - \dot{m}_{\text{out}} \cdot h_{\text{out}} \; \forall i \in \text{inlets} \tag{27}$$

$$\begin{aligned} 0 &= p_{\text{in},1} - p_{\text{in},i} \; \forall i \in \text{inlets} \setminus \{1\} \\ 0 &= p_{\text{in},1} - p_{\text{out},j} \; \forall j \in \text{outlets} \end{aligned} \tag{28}$$

2.7 Components of type Pump

2.7.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1] \tag{29}$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{30}$$

2.7.2 Inputs specified

label	eta_s_char (31)
pump	True

Table 5: Parameters of components of type Pump

2.7.3 Equations applied

$$0 = (h_{\text{out}} - h_{\text{in}}) \cdot \eta_{\text{s,design}} \cdot f\left(X\right) - (h_{out,s} - h_{in}) \tag{31}$$

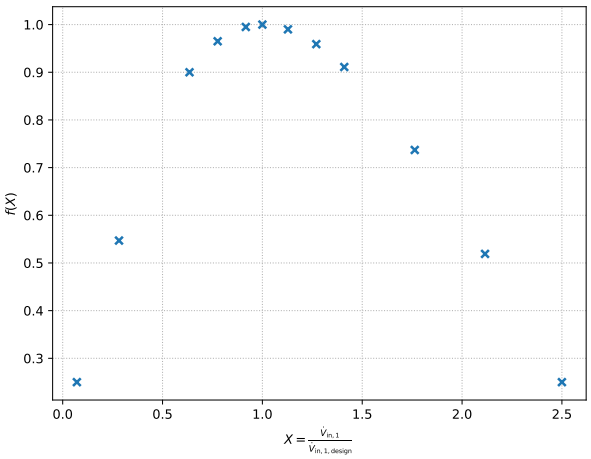

Figure 7: Characteristics of pump (eq. 31)

2.8 Components of type HeatExchangerSimple

2.8.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1] \tag{32}$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{33}$$

2.8.2 Inputs specified

label	pr (34)
steam generator	0.950

Table 6: Parameters of components of type HeatExchangerSimple

2.8.3 Equations applied

$$0 = p_{\text{in},1} \cdot pr - p_{\text{out},1} \tag{34}$$

3 Busses in offdesign mode

3.1 Bus “power”

This bus is used for postprocessing only.

label	$\dot{E}_{\mathrm{comp}}$	$\dot{E}_{\mathrm{bus}}$	η
high pressure turbine	$\dot{m}_{\mathrm{in}} \cdot (h_{\mathrm{out}} - h_{\mathrm{in}})$	$\dot{E}_{\mathrm{comp}} \cdot \eta$	$f\left(X\right)$ (8)
low pressure turbine	$\dot{m}_{\mathrm{in}} \cdot (h_{\mathrm{out}} - h_{\mathrm{in}})$	$\dot{E}_{\mathrm{comp}} \cdot \eta$	$f\left(X\right)$ (8)
pump	$\dot{m}_{\mathrm{in}} \cdot (h_{\mathrm{out}} - h_{\mathrm{in}})$	$\frac{\dot{E}_{\mathrm{comp}}}{\eta}$	$f\left(X\right)$ (9)

Table 7: power

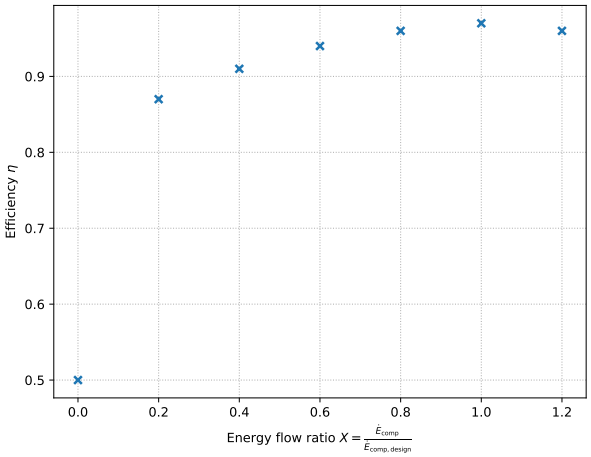

Figure 8: Bus efficiency characteristic

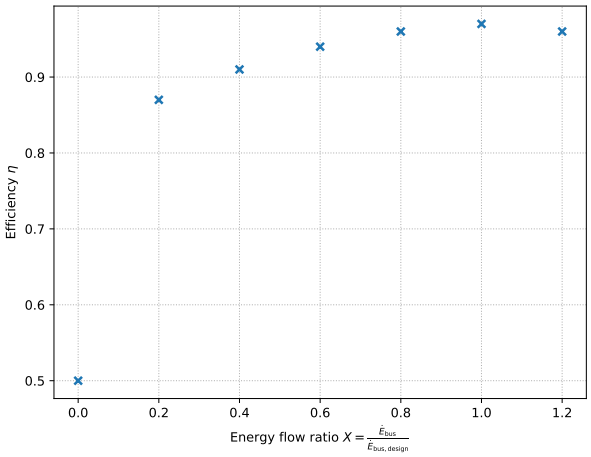

Figure 9: Bus efficiency characteristic

3.2 Bus “heat”

This bus is used for postprocessing only.

label	$\dot{E}_{\mathrm{comp}}$	$\dot{E}_{\mathrm{bus}}$	η
condenser	$\dot{m}_{\mathrm{in},1} \cdot (h_{\mathrm{out},1} - h_{\mathrm{in},1})$	$\dot{E}_{\mathrm{comp}} \cdot \eta$	-1.000

Table 8: heat