## 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 | T in °C (1) | p in bar (2) |
|---|---|---|
| cycle closer:out1_turbine:in1 | 500.000 | - |
| cooling water inlet:out1_condenser:in2 | 20.000 | 5.000 |
| condenser:out2_cooling water outlet:in1 | 30.000 | - |

Table 1: Specified connection parameters

## 1.2 Equations applied

$$0 = T\left(p, h\right) - T_{\text{spec}} \tag{1}$$

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

## 1.3 Specified fluids

| label | water (3) |
|---|---|
| cycle closer:out1_turbine:in1 | 1.000 |
| cooling water inlet:out1_condenser:in2 | 1.000 |

Table 2: Specified fluids

## 1.4 Equations applied

$$0 = x_{\text{water}} - x_{\text{water,spec}} \tag{3}$$

# 2 Components in offdesign mode

## 2.1 Components of type CycleCloser

### 2.1.1 Mandatory constraints

$$0 = p_{\text{in},i} - p_{\text{out},i} \; \forall i \in [1] \tag{4}$$

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

## 2.2 Components of type Turbine

### 2.2.1 Mandatory constraints

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

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{7}$$

### 2.2.2 Inputs specified

| label | eta_s_char (8) | cone (9) |
|---|---|---|
| turbine | True | True |

Table 3: Parameters of components of type Turbine

### 2.2.3 Equations applied

$$0 = -\left(h_{\mathrm{out}} - h_{\mathrm{in}}\right) + \eta_{\mathrm{s,design}} \cdot f\left(X\right) \cdot \left(h_{\mathrm{out,s}} - h_{\mathrm{in}}\right) \tag{8}$$

$$0 = \frac{\dot{m}_{\mathrm{in,design}} \cdot p_{\mathrm{in}}}{p_{\mathrm{in,design}}} \cdot \sqrt{\frac{p_{\mathrm{in,design}} \cdot v_{\mathrm{in}}}{p_{\mathrm{in}} \cdot v_{\mathrm{in,design}}} \cdot \frac{1 - \left(\frac{p_{\mathrm{out}}}{p_{\mathrm{in}}}\right)^2}{1 - \left(\frac{p_{\mathrm{out,design}}}{p_{\mathrm{in,design}}}\right)^2}} - \dot{m}_{\mathrm{in}} \tag{9}$$

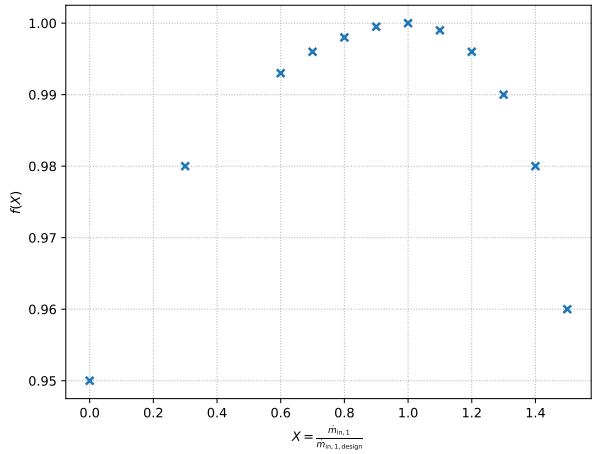


Figure 1: Characteristics of turbine (eq. 8)

## 2.3 Components of type Condenser

### 2.3.1 Mandatory constraints

$$0 = \dot{m}_{\mathrm{in},i} - \dot{m}_{\mathrm{out},i} \; \forall i \in [1, 2] \tag{10}$$

$$0 = x_{fl,\mathrm{in},i} - x_{fl,\mathrm{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1, 2] \tag{11}$$

$$0 = \dot{m}_{\mathrm{in},1} \cdot \left(h_{\mathrm{out},1} - h_{\mathrm{in},1}\right) + \dot{m}_{\mathrm{in},2} \cdot \left(h_{\mathrm{out},2} - h_{\mathrm{in},2}\right) \tag{12}$$

### 2.3.2 Inputs specified

| label | pr1 (13) | zeta2 (14) | kA_char (15) | subcooling (16) |
|---|---|---|---|---|
| condenser | 1.000 | 70.506 | True | True |

Table 4: Parameters of components of type Condenser

### 2.3.3 Equations applied

$$0 = p_{\text{in},1} \cdot pr1 - p_{\text{out},1} \tag{13}$$

$$0 = \begin{cases} p_{\text{in},2} - p_{\text{out},2} & |\dot{m}_{\text{in},2}| < 0.0001\,\text{kg/s} \\ \frac{\zeta}{D^4} - \frac{(p_{\text{in},2} - p_{\text{out},2}) \cdot \pi^2}{8 \cdot \dot{m}_{\text{in},2} \cdot |\dot{m}_{\text{in},2}| \cdot \frac{v_{\text{in},2} + v_{\text{out},2}}{2}} & |\dot{m}_{\text{in},2}| \geq 0.0001\,\text{kg/s} \end{cases} \tag{14}$$

$$\begin{aligned} 0 =& \dot{m}_{\text{in},1} \cdot (h_{\text{out},1} - h_{\text{in},1}) \\ &+ kA_{\text{design}} \cdot f_{\text{kA}} \cdot \frac{T_{\text{out},1} - T_{\text{in},2} - T_{\text{sat}}(p_{\text{in},1}) + T_{\text{out},2}}{\ln \frac{T_{\text{out},1} - T_{\text{in},2}}{T_{\text{sat}}(p_{\text{in},1}) - T_{\text{out},2}}} \\ f_{\text{kA}} =& \frac{2}{\frac{1}{f(X_2)} + \frac{1}{f(X_2)}} \end{aligned} \tag{15}$$

$$0 = h_{\text{out},1} - h\left(p_{\text{out},1}, x = 0\right) \tag{16}$$

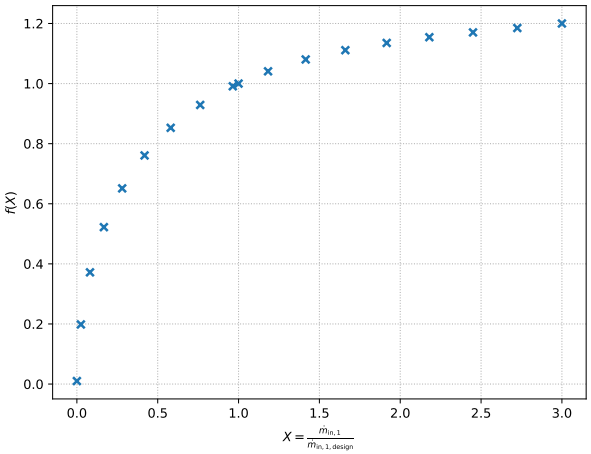


Figure 2: Characteristics of condenser (eq. 15)

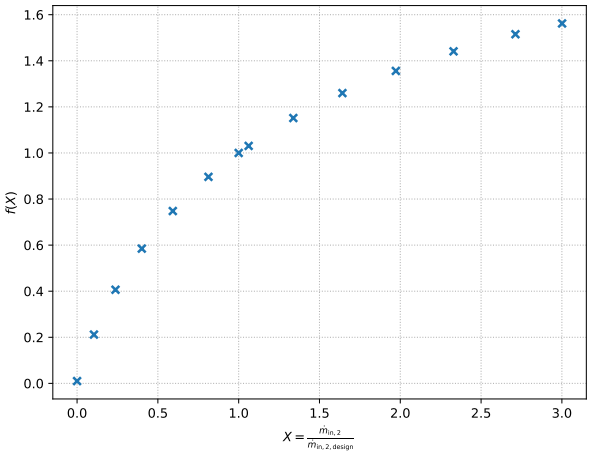


Figure 3: Characteristics of condenser (eq. 15)

## 2.4 Components of type Pump

### 2.4.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1] \tag{17}$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{18}$$

### 2.4.2 Inputs specified

| | |
|---|---|
| label | eta_s_char (19) |
| pump | True |

Table 5: Parameters of components of type Pump

### 2.4.3 Equations applied

$$0 = (h_{\text{out}} - h_{\text{in}}) \cdot \eta_{\text{s,design}} \cdot f(X) - (h_{out,s} - h_{in}) \tag{19}$$

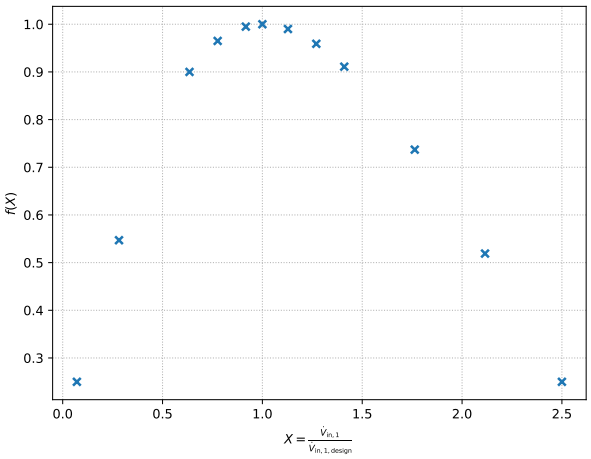


Figure 4: Characteristics of pump (eq. 19)

## 2.5 Components of type HeatExchangerSimple

### 2.5.1 Mandatory constraints

$$0 = \dot{m}_{\text{in},i} - \dot{m}_{\text{out},i} \; \forall i \in [1] \tag{20}$$

$$0 = x_{fl,\text{in},i} - x_{fl,\text{out},i} \; \forall fl \in \text{network fluids}, \forall i \in [1] \tag{21}$$

### 2.5.2 Inputs specified

| label | pr (22) |
|---|---|
| steam generator | 0.950 |

Table 6: Parameters of components of type HeatExchangerSimple

### 2.5.3 Equations applied

$$0 = p_{\text{in},1} \cdot pr - p_{\text{out},1} \tag{22}$$

# 3 Busses in offdesign mode

## 3.1 Bus “total output power”

Specified total value of energy flow: $\dot{E}_{\text{bus}} = -9000000.000\,\text{W}$

$$0 = \dot{E}_{\text{bus}} - \sum_i \dot{E}_{\text{bus},i} \tag{23}$$

| label | $\dot{E}_{\text{comp}}$ | $\dot{E}_{\text{bus}}$ | $\eta$ |
|---|---|---|---|
| turbine | $\dot{m}_{\text{in}} \cdot (h_{\text{out}} - h_{\text{in}})$ | $\dot{E}_{\text{comp}} \cdot \eta$ | $f\left(X\right)$ (5) |
| pump | $\dot{m}_{\text{in}} \cdot (h_{\text{out}} - h_{\text{in}})$ | $\frac{\dot{E}_{\text{comp}}}{\eta}$ | $f\left(X\right)$ (6) |

Table 7: total output power

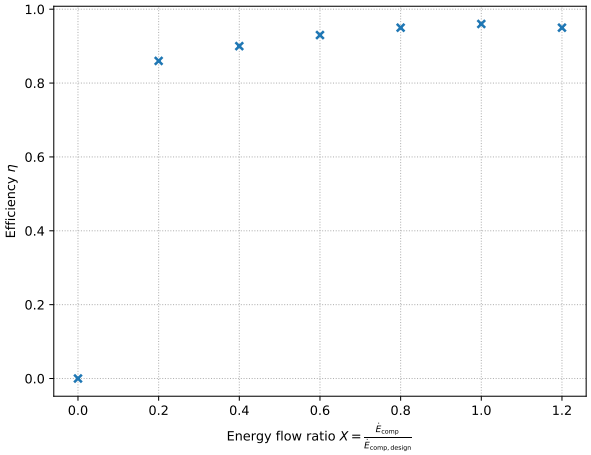


Figure 5: Bus efficiency characteristic

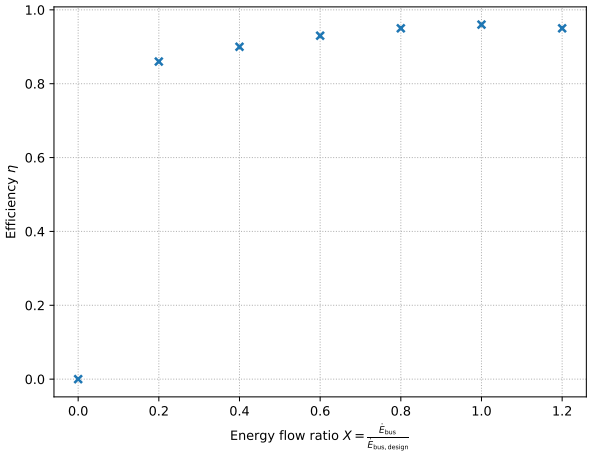


Figure 6: Bus efficiency characteristic