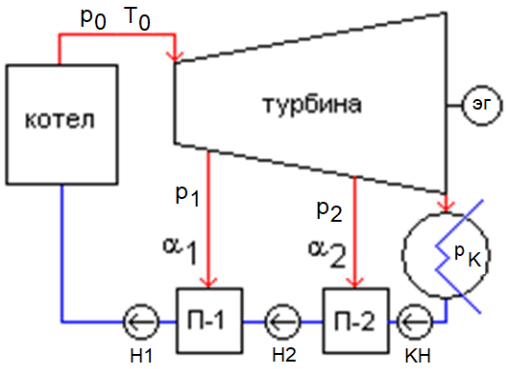
Создано в бесплатной версии SMath Studio

Расчет термического КПД паротурбинной установки с двумя регенеративными подогревателями

$p_0 := 130\ \text{atm}$ $T_0 := 540\ °\text{C}$



Параметры ПТУ

$p_K := 30\ \text{mmHg}$

$\eta_T(p_0, T_0, p_1, p_2, p_K) :=$

$wf := \text{"H2O"}$

$T_K := \text{CoolProp_Props}(\text{"T"}, \text{"P"}, p_K, \text{"Q"}, 0.5, wf)$ $h'_{KH} := \text{CoolProp_Props}$

$T'_{H2} := \text{CoolProp_Props}(\text{"T"}, \text{"P"}, p_2, \text{"Q"}, 0.5, wf)$ $h'_{H2} := \text{CoolProp_Prop}$

$T'_{H1} := \text{CoolProp_Props}(\text{"T"}, \text{"P"}, p_1, \text{"Q"}, 0.5, wf)$ $h'_{H1} := \text{CoolProp_Prop}$

$T_{ПВ} := \text{CoolProp_Props}(\text{"T"}, \text{"P"}, p_0, \text{"S"}, s_{H1}, wf)$ $h''_{H2} := \text{CoolProp_Prop}$

$h_0 := \text{CoolProp_Props}(\text{"H"}, \text{"P"}, p_0, \text{"T"}, T_0, wf)$ $s := \text{CoolProp_Props}(\text{"S"}$

$h_1 := \text{CoolProp_Props}(\text{"H"}, \text{"P"}, p_1, \text{"S"}, s, wf)$ $h_2 := \text{CoolProp_Props}(\text{"H"}$

$T''_{H2} := \text{CoolProp_Props}(\text{"T"}, \text{"P"}, p_2, \text{"S"}, s_{H2}, wf)$ $h''_{KH} := \text{CoolProp_Pr}$

$$\begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} := \text{roots}\left(\begin{bmatrix} \alpha_1 \cdot h_1 + (1-\alpha_1)\cdot h''_{H2} = 1\cdot h'_{H1} \\ \alpha_2 \cdot h_2 + (1-\alpha_1-\alpha_2)\cdot h''_{KH} = (1-\alpha_1)\cdot h'_{H2} \end{bmatrix}, \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix}\right)$$

$l_{01} := 1\cdot(h_0 - h_1)$ $l_{12} := (1-\alpha_1)\cdot(h_1 - h_2)$ $l_{2K} := (1-\alpha_1-\alpha_2)\cdot(h_2 - h_K)$

$l_{KH} := (1-\alpha_1-\alpha_2)\cdot(h''_{KH} - h'_{KH})$ $l_{H2} := (1-\alpha_1)\cdot(h''_{H2} - h'_{H2})$

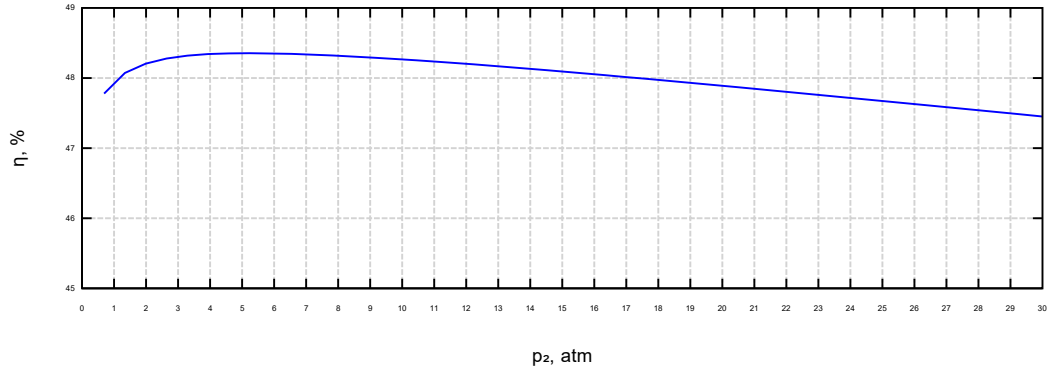
$l_{ПН} := 1\cdot(h_{ПВ} - h'_{H1})$ $q := 1\cdot(h_0 - h_{ПВ})$

$$\frac{l_{01} + l_{12} + l_{2K} - l_{KH} - l_{H2} - l_{ПН}}{q}$$

$\eta_T(p_0, T_0, p_0, p_0, p_K) = 43.88\ \%$ $\eta_T(p_0, T_0, p_K, p_K, p_K) = 43.88\ \%$

$\eta_T(p_0, T_0, 30\ \text{atm}, 30\ \text{atm}, p_K) = 46.82\ \%$ $\eta_T(p_0, T_0, 70\ \text{atm}, 30\ \text{atm}, p_K) = 47.45\ \%$

$$p := \left[p_0, p_0 - \frac{p_0 - p_K}{200} .. p_K\right]$$



Не для коммерческого использования

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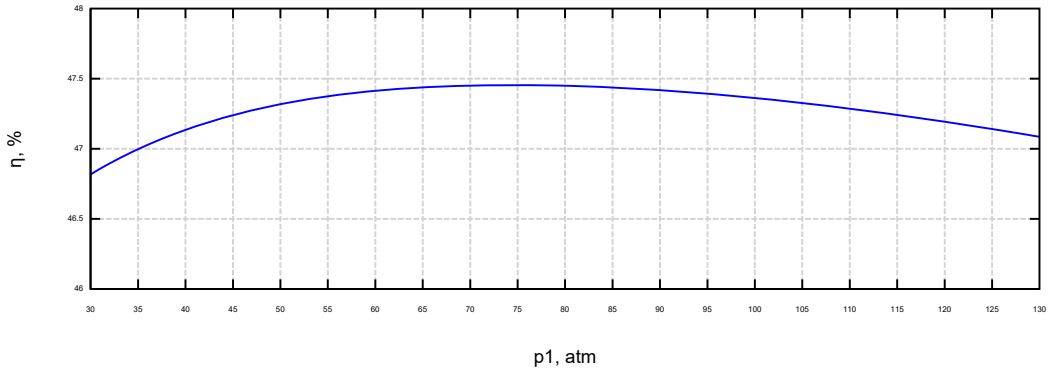
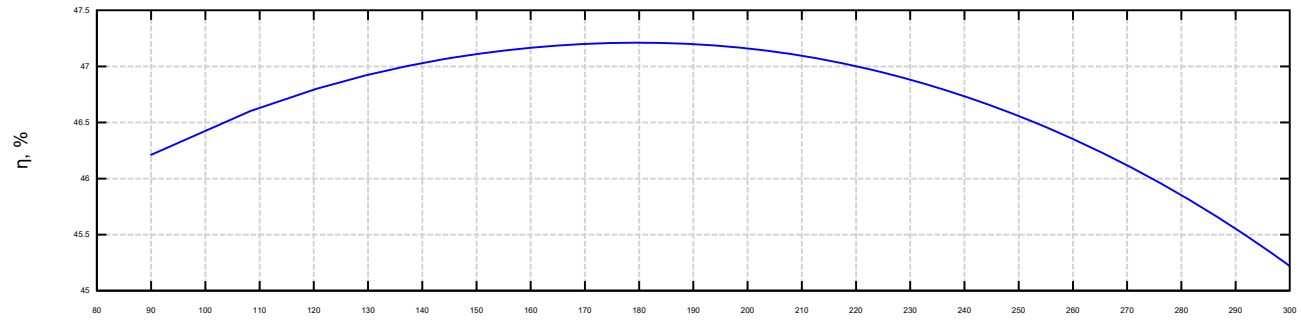
$$\text{augment}\left(\frac{p}{\text{atm}}, \frac{\eta_T(p_0, T_0, 70\ \text{atm}, p, p_K)}{\%}\right)$$



$$\text{augment}\left(\frac{p}{\text{atm}}, \frac{\overrightarrow{\eta_T(p_0, T_0, p, 30\ \text{atm}, p_K)}}{\%}\right)$$

Один отбор пара - параметрический график



$$\text{augment}\left(\frac{\overrightarrow{\text{CoolProp_Props}("T", "P", p, "Q", 0, "H2O")}}{\text{K}} - 273.15, \frac{\overrightarrow{\eta_T(p_0, T_0, p, p, p_K)}}{\%}\right)$$

Не для коммерческого использования