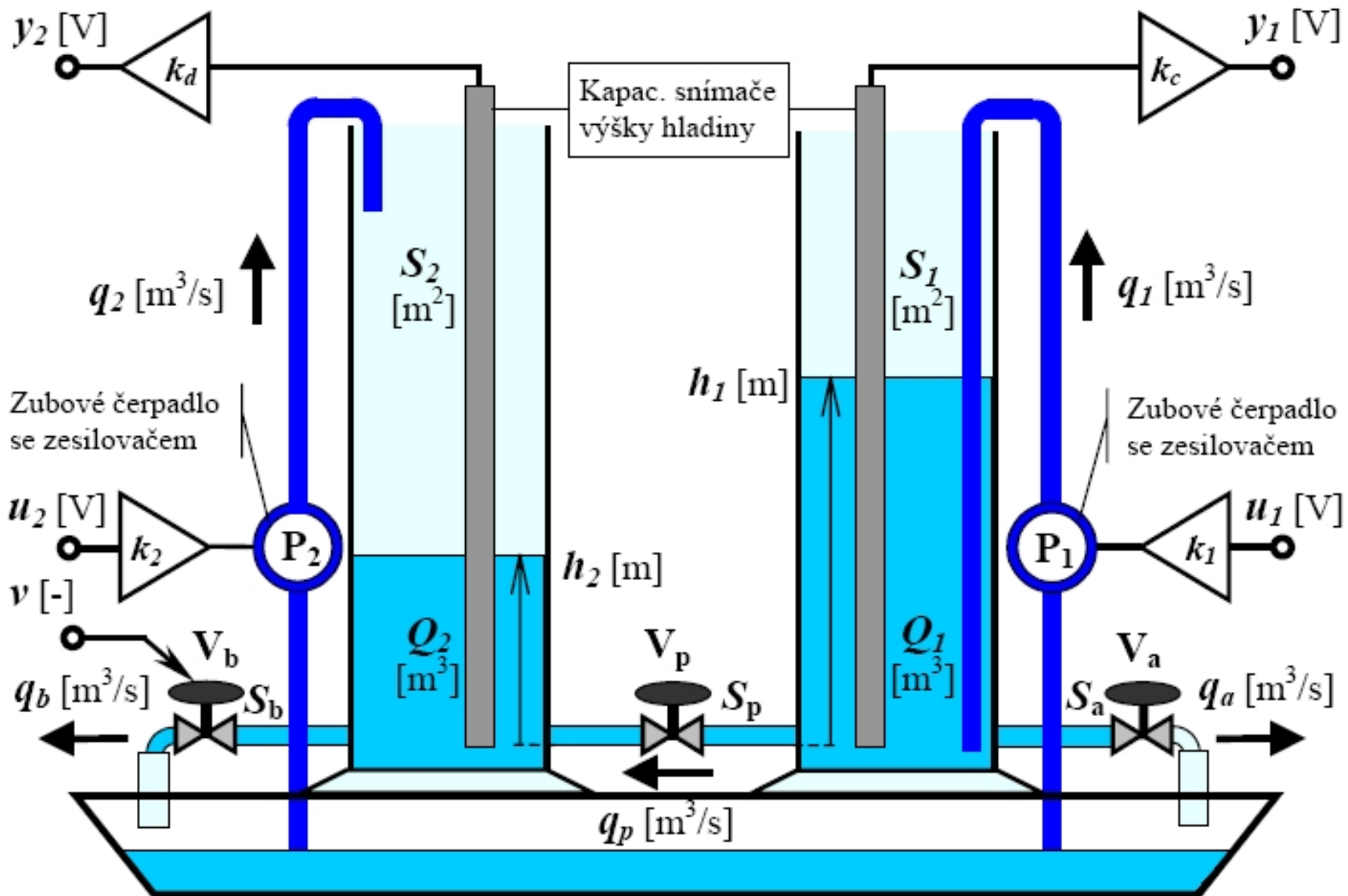


VODÁRNA 2

MODEL VODÁRNY 2



MODEL VODÁRNY 2

Zákon zachování energie:

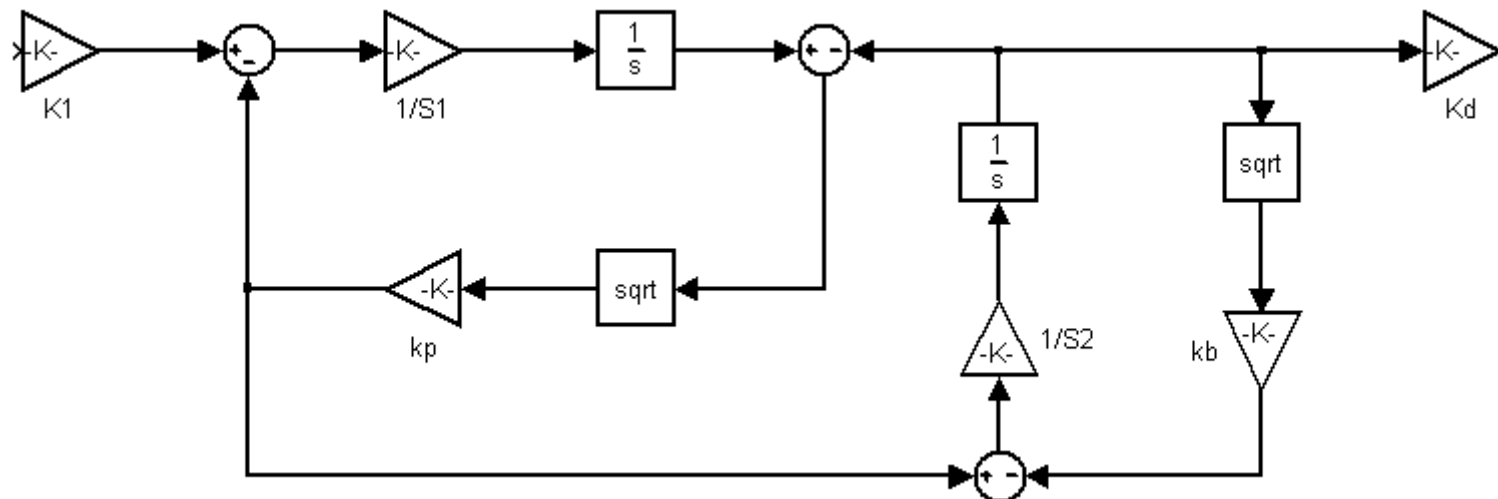
$$E_k = \frac{1}{2} \cdot m \cdot v^2 = m \cdot g \cdot h = E_p$$

Stavové rovnice:

$$\dot{h}_1 = \frac{k_1 \cdot u_1}{S_1} - \frac{k_p}{S_1} \cdot \sqrt{h_1 - h_2}$$

$$\dot{h}_2 = \frac{k_p}{S_2} \cdot \sqrt{h_1 - h_2} - \frac{k_b}{S_2} \cdot \sqrt{h_2}$$

$$y_2 = k_d \cdot h_2$$



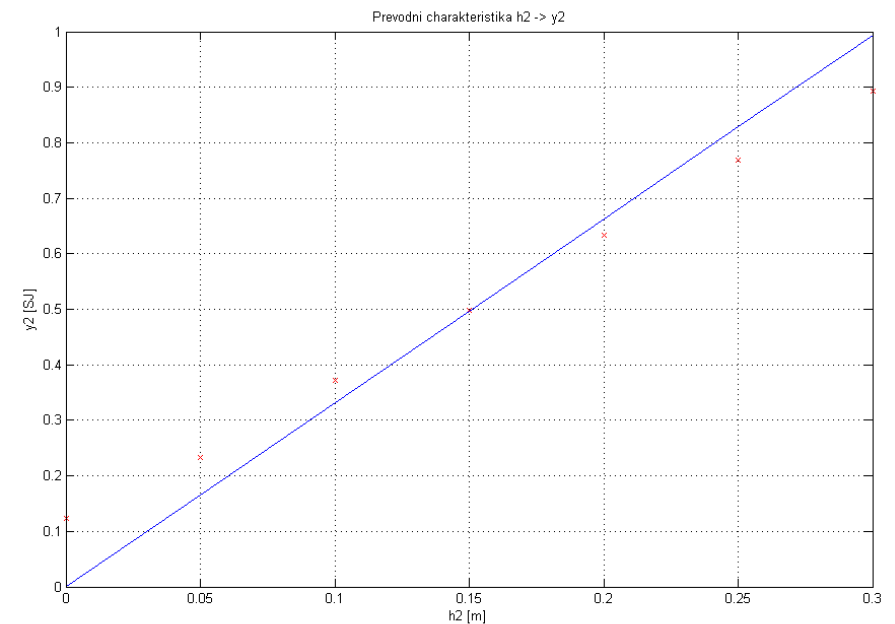
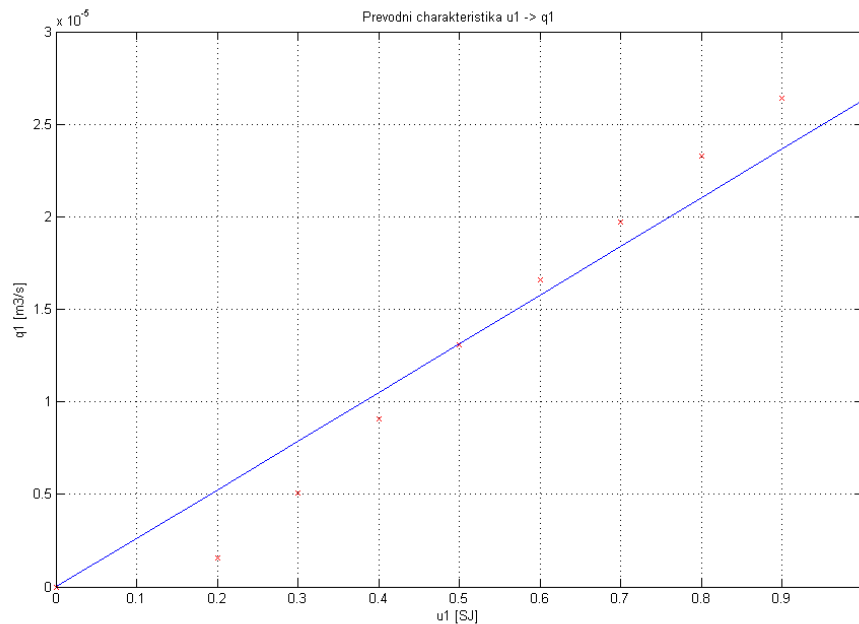
MODEL VODÁRNY 2

Konstanta čerpadla k_l :

- $k_l = 2,6317 \cdot 10^{-5} \text{ m}^3/\text{SJ} \cdot \text{s}$
- $k_l = 2,6317 \cdot 10^{-6} \text{ m}^3/\text{V} \cdot \text{s}$

Konstanta snímače výšky hladiny k_d :

- $k_d = 3,3145 \text{ SJ}/\text{m}$
- $k_d = 33,1454 \text{ V}/\text{m}$



MODEL VODÁRNY 2

Konstanta přepouštěcího ventilu k_p :

- $k_p = 3,7854 \cdot 10^{-5} \text{ m}^2/\text{s}$
- $k_p = 3,5379 \cdot 10^{-5} \text{ m}^2/\text{s}$

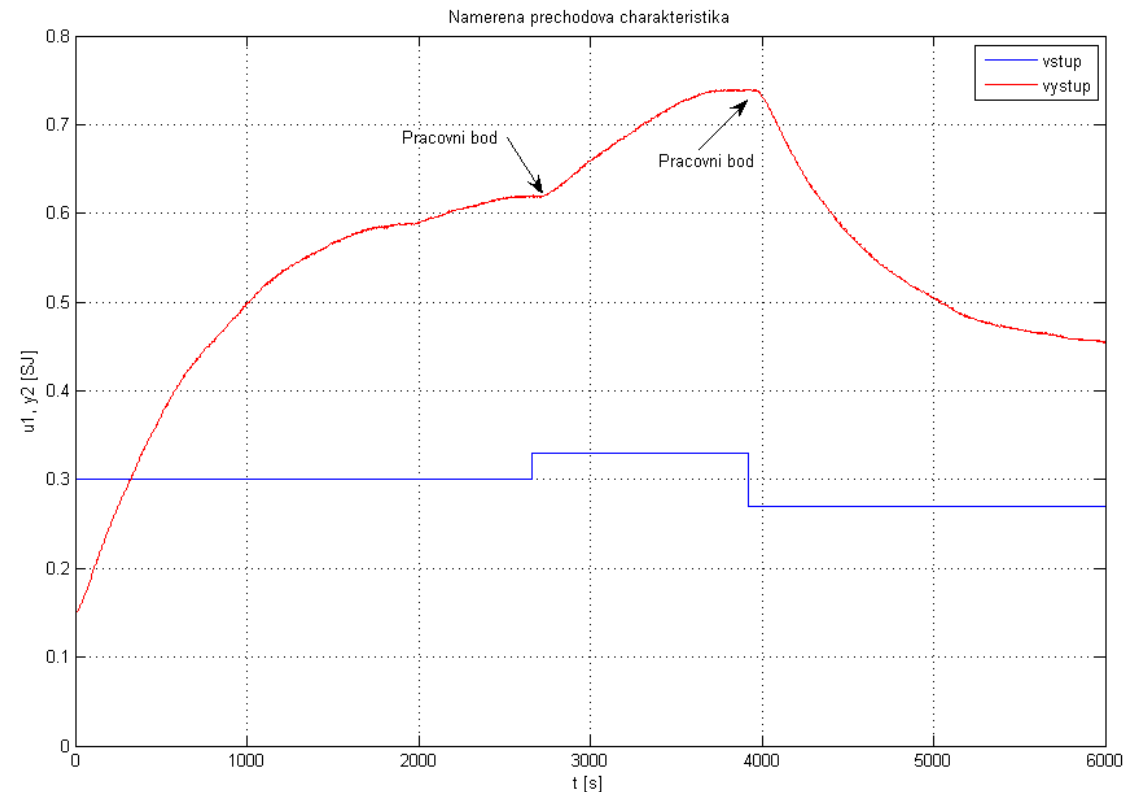
Konstanta vypouštěcího ventilu k_b :

- $k_b = 1,8306 \cdot 10^{-5} \text{ m}^2/\text{s}$
- $k_b = 1,7607 \cdot 10^{-5} \text{ m}^2/\text{s}$

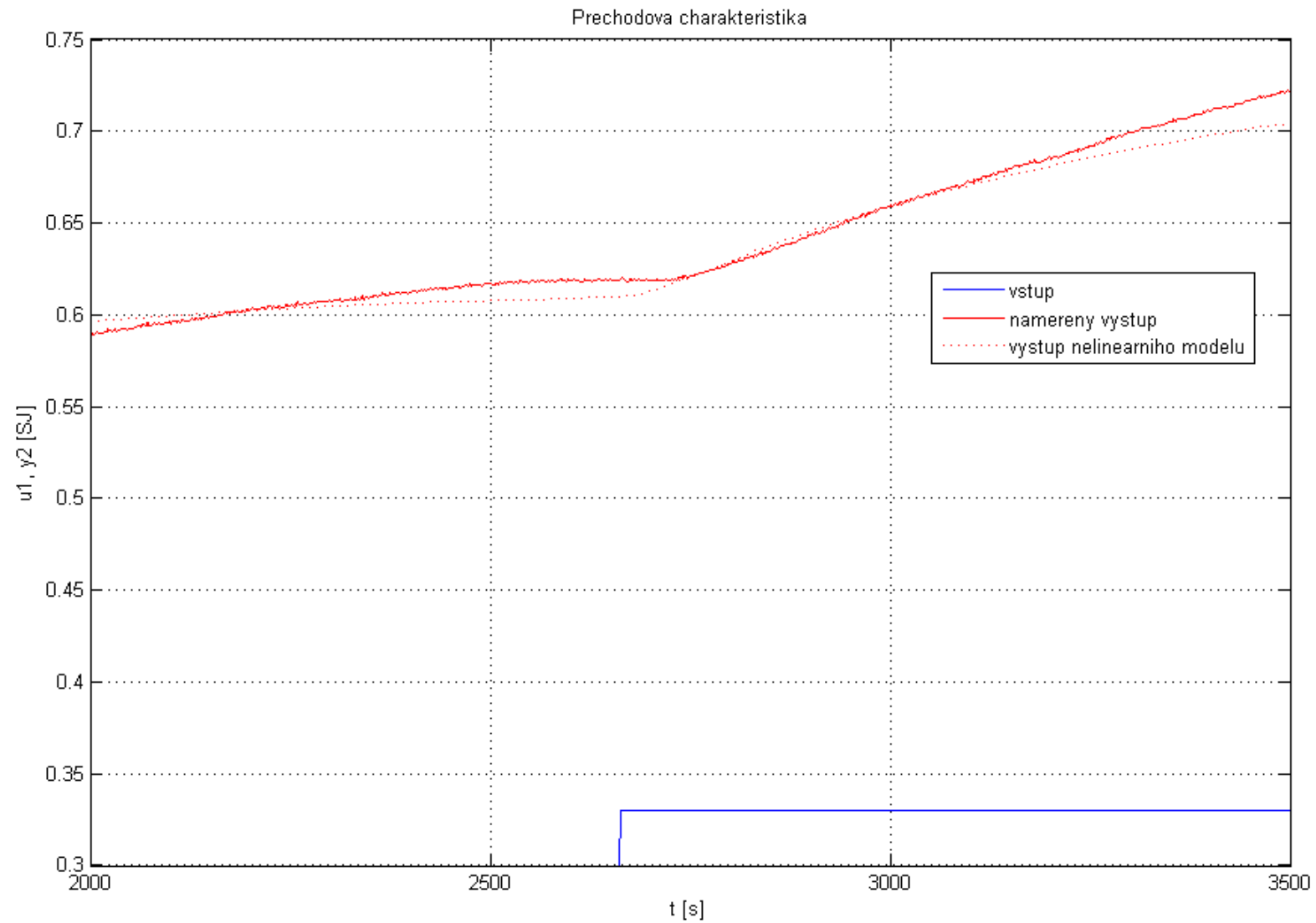
$$\dot{h}_1 = \frac{k_1 \cdot u_1}{S_1} - \frac{k_p}{S_1} \cdot \sqrt{h_1 - h_2}$$

$$\dot{h}_2 = \frac{k_p}{S_2} \cdot \sqrt{h_1 - h_2} - \frac{k_b}{S_2} \cdot \sqrt{h_2}$$

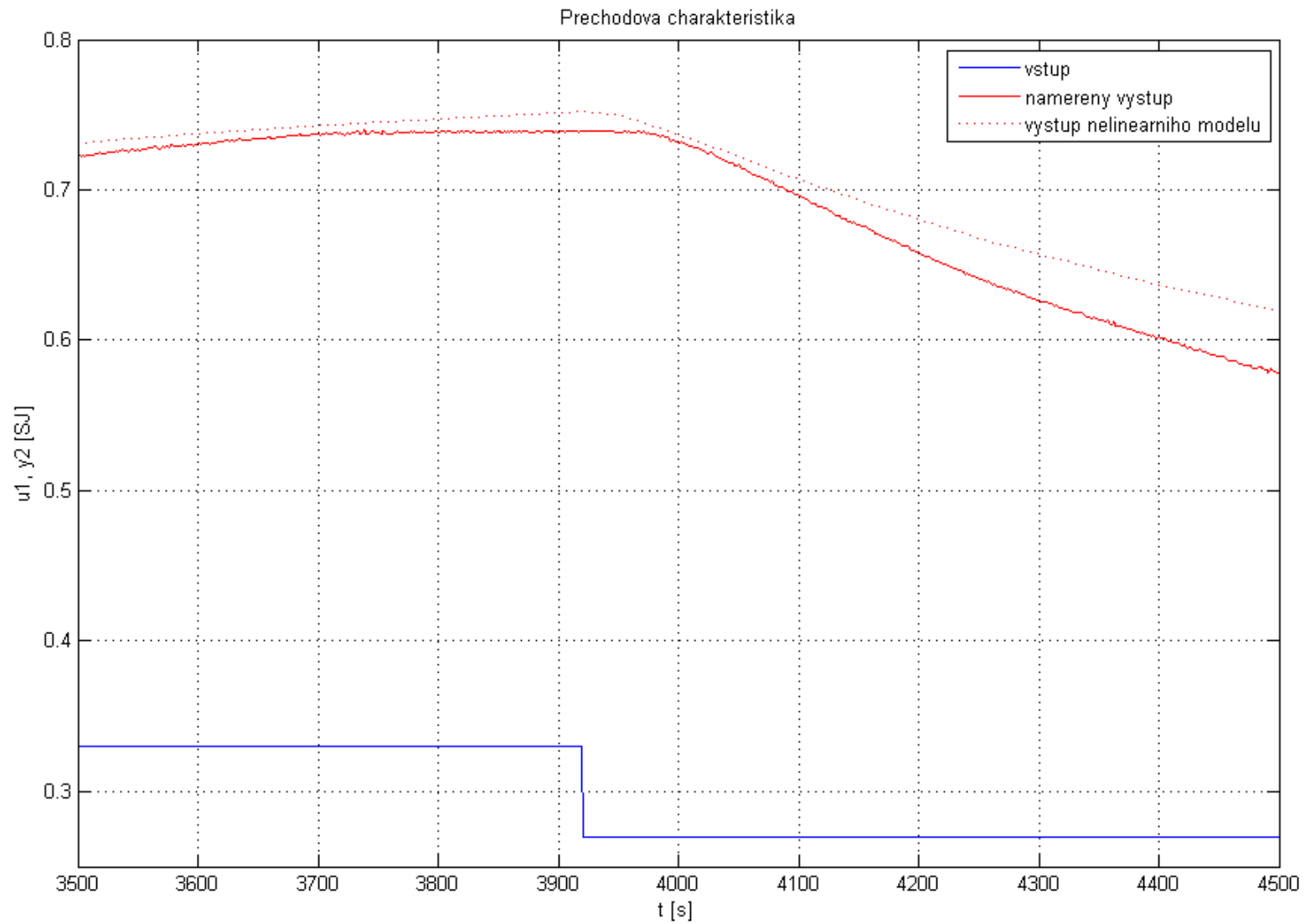
$$y_2 = k_d \cdot h_2$$



MODEL VODÁRNY 2



MODEL VODÁRNY 2



MODEL VODÁRNY 2

Linearizace stavových rovnic:

$$\dot{x}(t) = \begin{bmatrix} \frac{-k_p}{2S_1 \cdot \sqrt{h_{10} - h_{20}}} & \frac{k_p}{2S_1 \cdot \sqrt{h_{10} - h_{20}}} \\ \frac{k_p}{2S_2 \cdot \sqrt{h_{10} - h_{20}}} & \frac{k_p \sqrt{h_{20}} - k_b \cdot \sqrt{h_{10} - h_{20}}}{2S_2 \cdot \sqrt{h_{20} \cdot \sqrt{h_{10} - h_{20}}}} \end{bmatrix} \Delta x(t) + \begin{bmatrix} \frac{k_1}{S_1} \\ 0 \end{bmatrix} \Delta u(t)$$

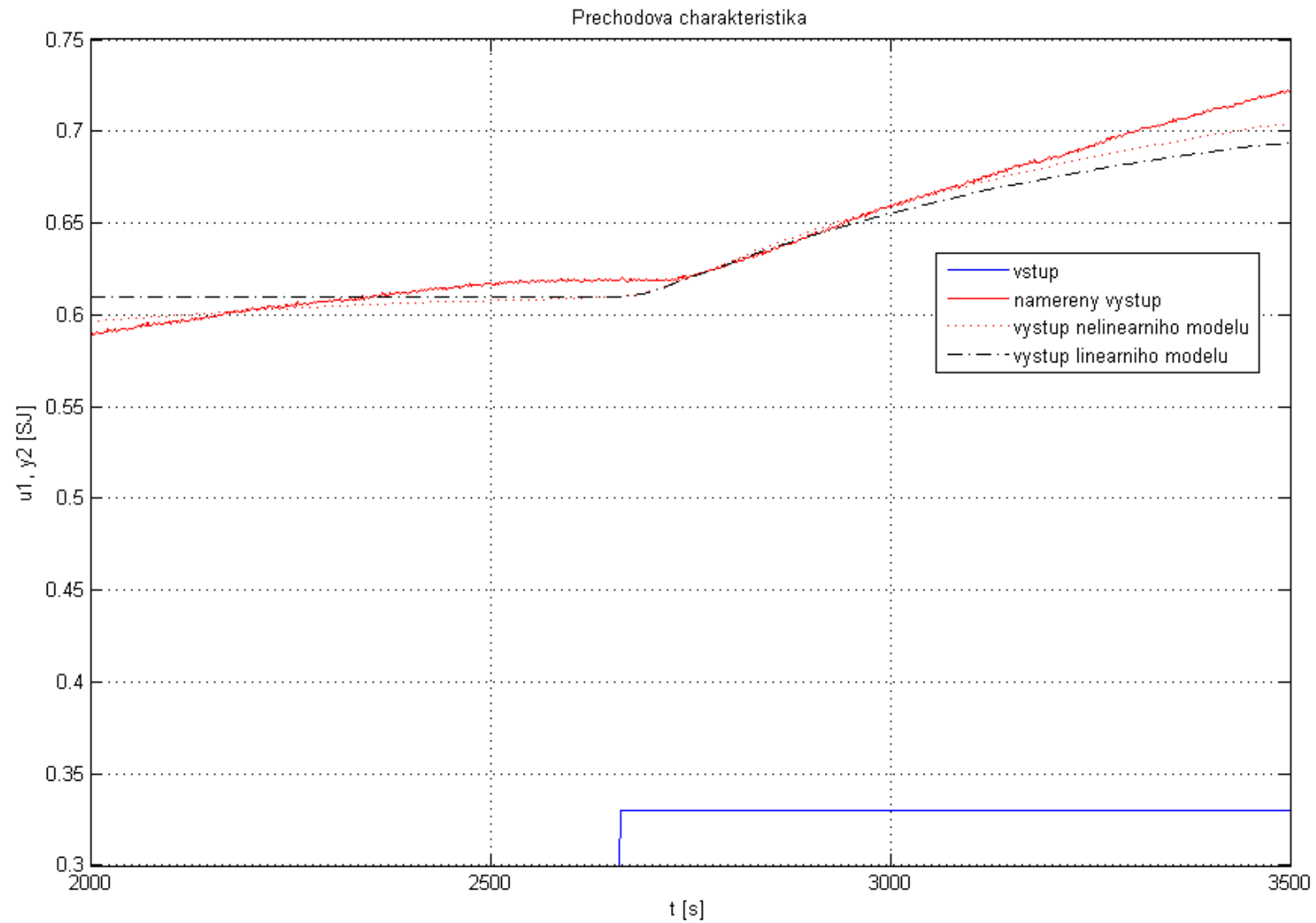
$$y(t) = [0 \quad k_d] \Delta x(t) + [0] \Delta u(t)$$

Numericky pro první a druhý pracovní bod:

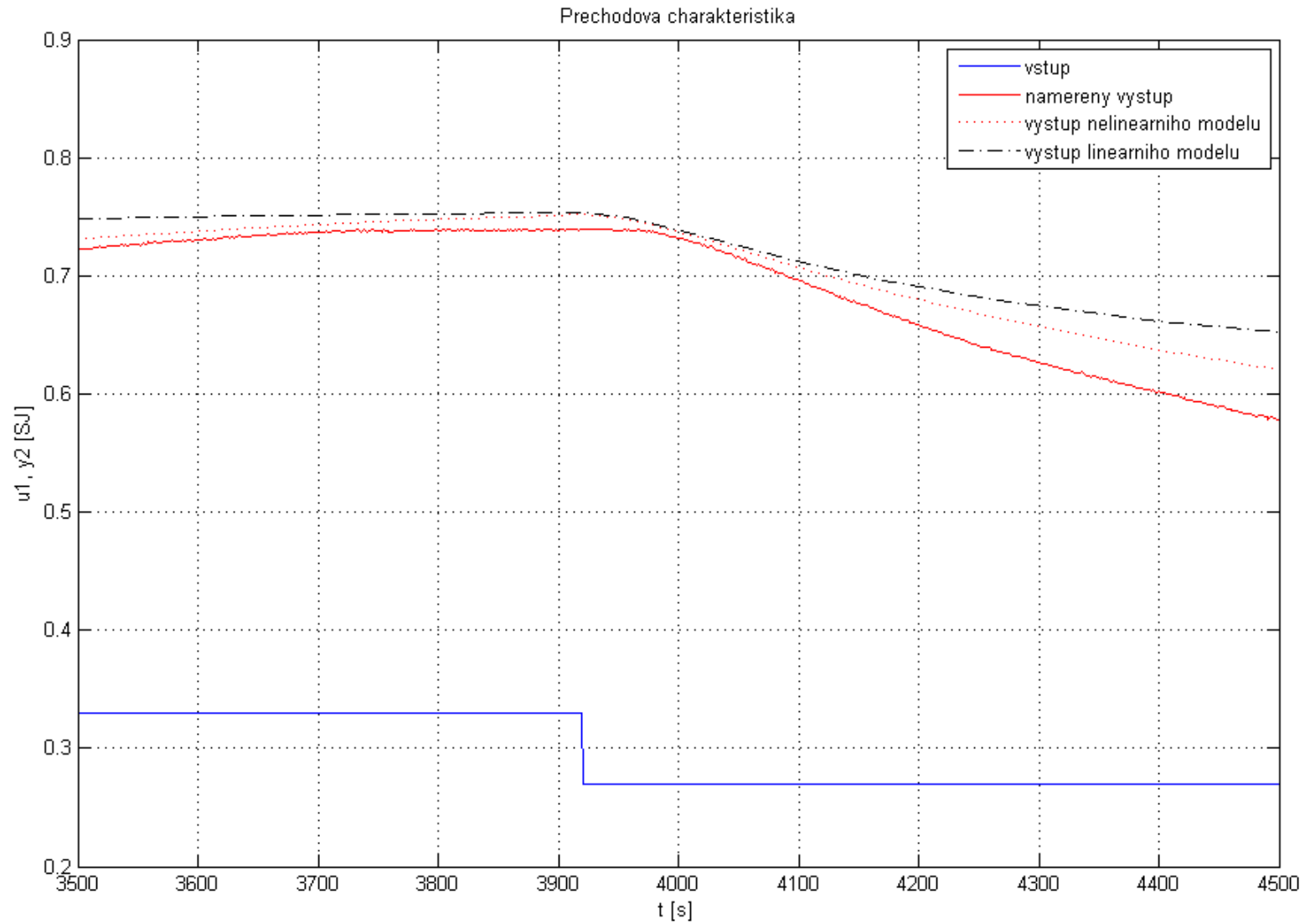
$$A = \begin{bmatrix} -0,01408 & 0,01408 \\ 0,01408 & -0,01792 \end{bmatrix} \quad B = \begin{bmatrix} 0,004131 \\ 0 \end{bmatrix} \quad C = [0 \quad 3,3145] \quad D = [0]$$

$$A = \begin{bmatrix} -0,01244 & 0,01244 \\ 0,01244 & -0,01562 \end{bmatrix} \quad B = \begin{bmatrix} 0,004131 \\ 0 \end{bmatrix} \quad C = [0 \quad 3,3145] \quad D = [0]$$

MODEL VODÁRNY 2

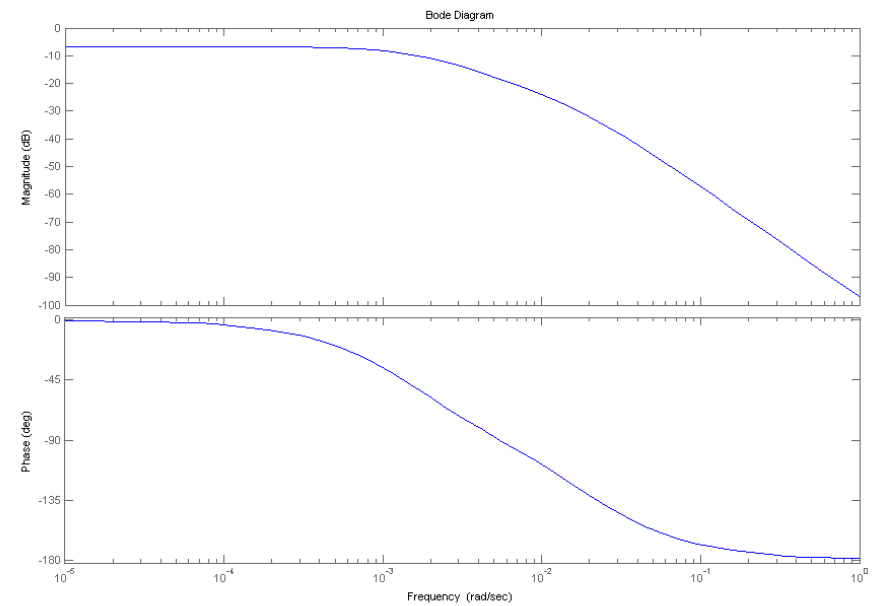
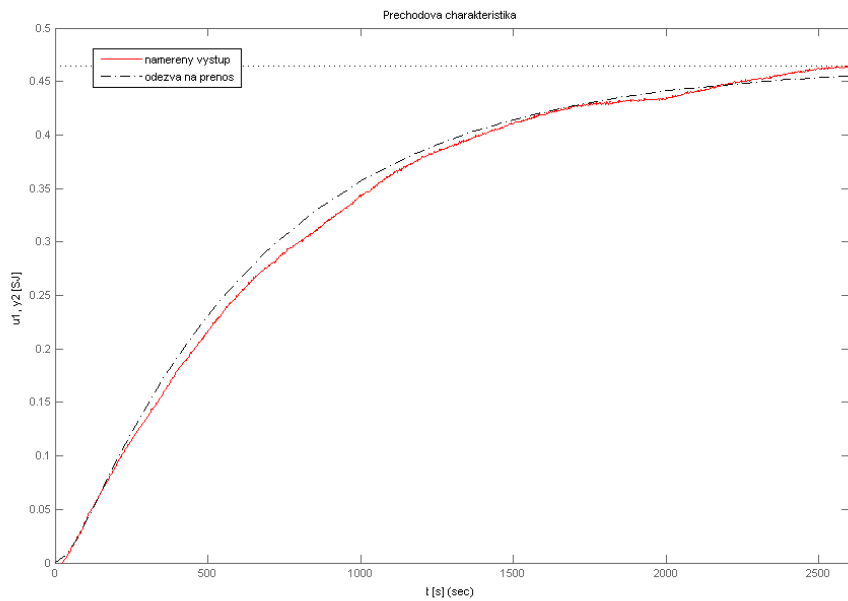


MODEL VODÁRNY 2



MODEL VODÁRNY 2

$$G(s) = \frac{0,4642}{33360s^2 + 700s + 1}$$



DĚKUJI ZA POZORNOST