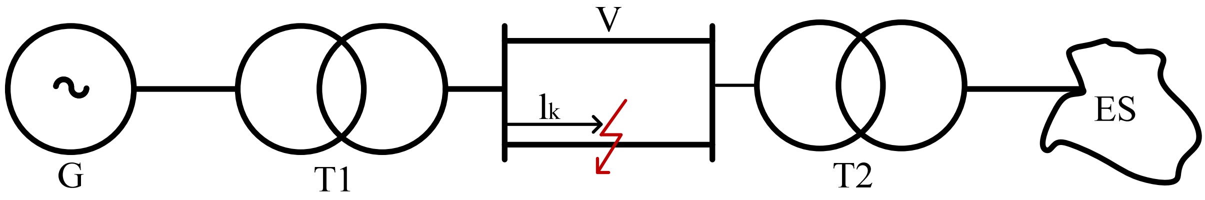
Transient stability in case of three-phase short-circuit on the power line:

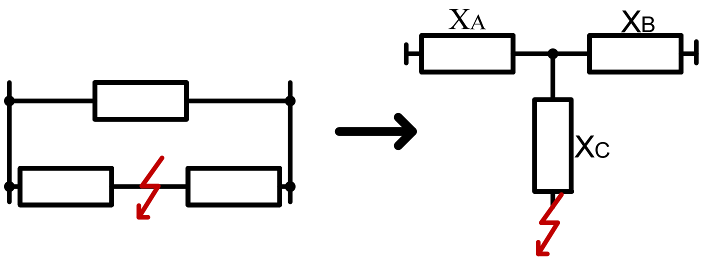


Parameters:
G: S_{nG} = 125 MVA, xd′ = 25%, Tg = 15 s
T1: S_{nT1} = 125 MVA, u_k = 12%, 10,5/220 kV
V: x_{1ved} = 0,42 Ω/km, l = 200 km, l_k = 100 km
T2: S_{nT1} = 125 MVA, u_k = 13%, 220/400 kV
ES: P = 100 MW, cosφ = 1

Calculation in relative values considering base values:
- base power S_v = 100 MVA
- base voltage U_v = 220 kV

1- Before short-circuit
2- During short-circuit
3- After short-circuit switch-off

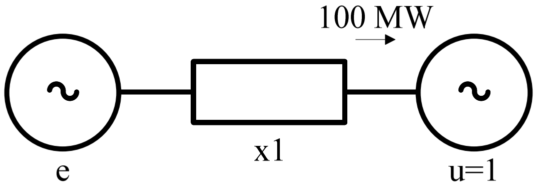
Δ -Y transfiguration:



$$x_{VAZ} = \frac{x_A \cdot x_B}{x_C}$$

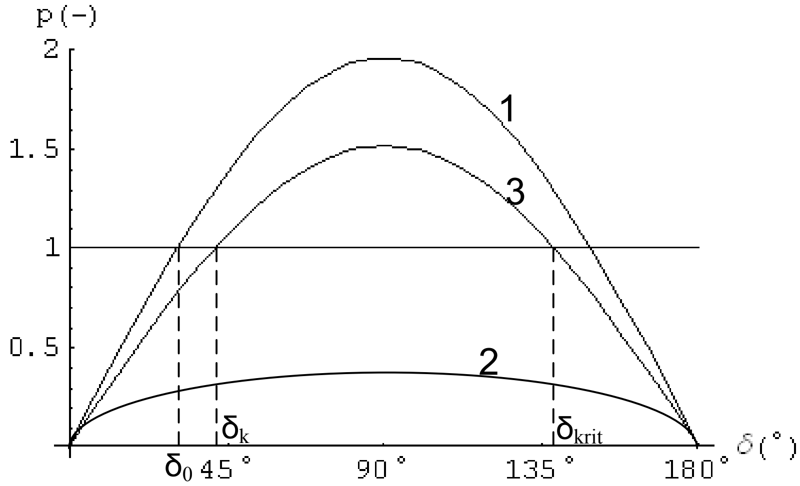
x_1 = 0,487
x_2 = 2,793
x_3 = 0,574

Before short-circuit:



$\delta_0 = 25{,}96°$ $\qquad\qquad$ $e = 1{,}11$

$$p_{1max} = \frac{e \cdot u}{x_1} = 2{,}285$$
$$p_{2max} = 0{,}398$$
$$p_{3max} = 1{,}939$$
$$p_{mech} = 1$$



$\delta_0 = 25{,}96°$
$\delta_k = 31{,}04°$
$\delta_{krit} = 148{,}96°$

Swing equation:

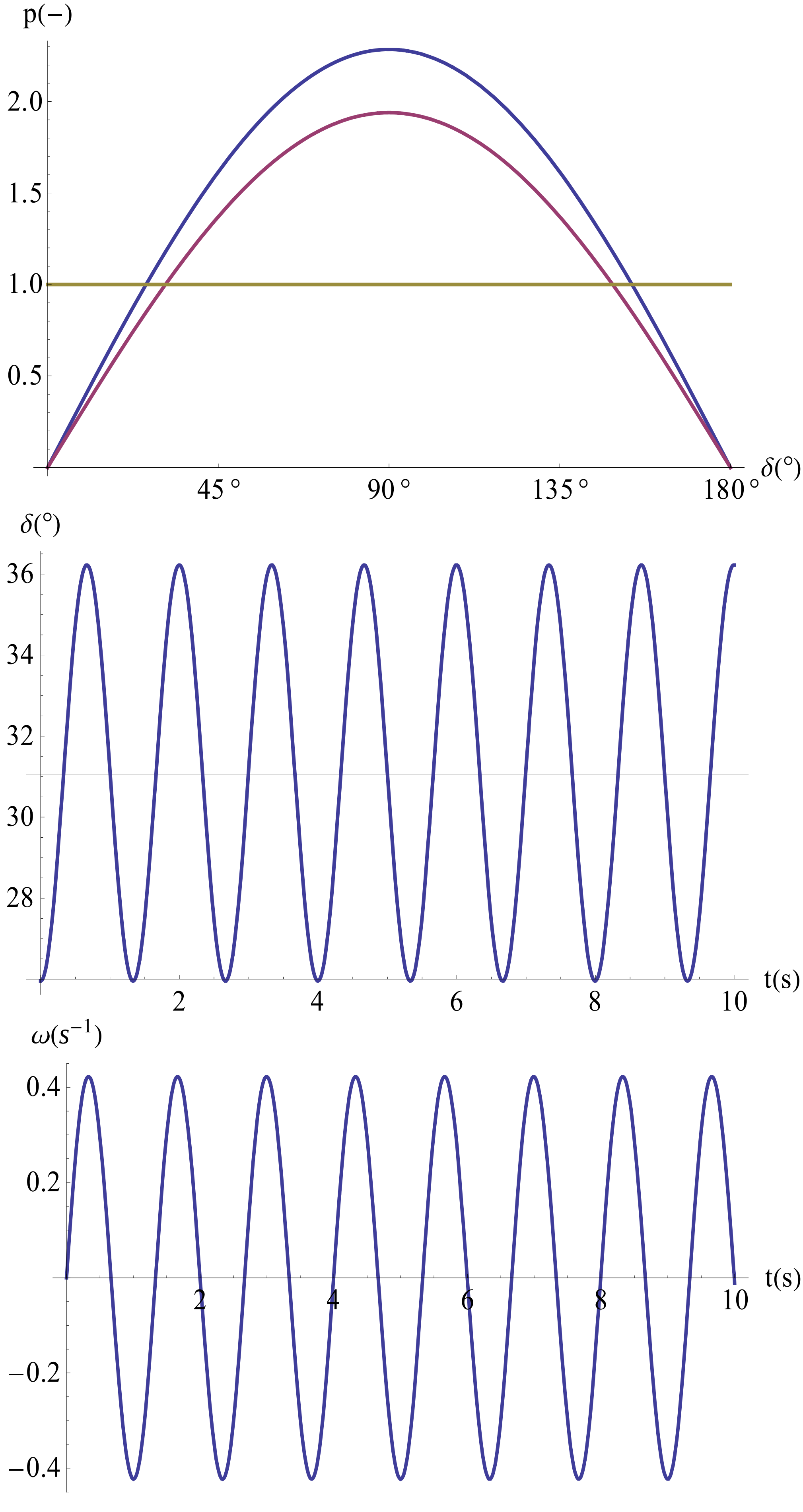
$$P_m - P_{max} * Sin\big(\delta(t)\big) = J * \omega(t) * \omega(t)' + B * \omega(t) * \delta(t)'$$

$$\omega(t) = \delta(t)' + \omega(0)$$

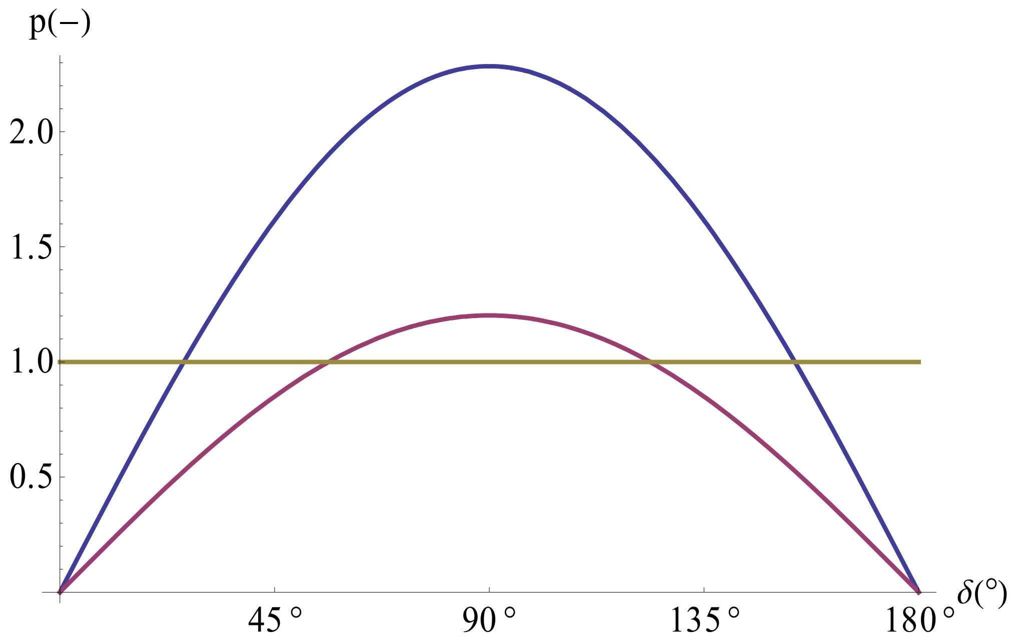
$$\delta(0) = \delta_0$$

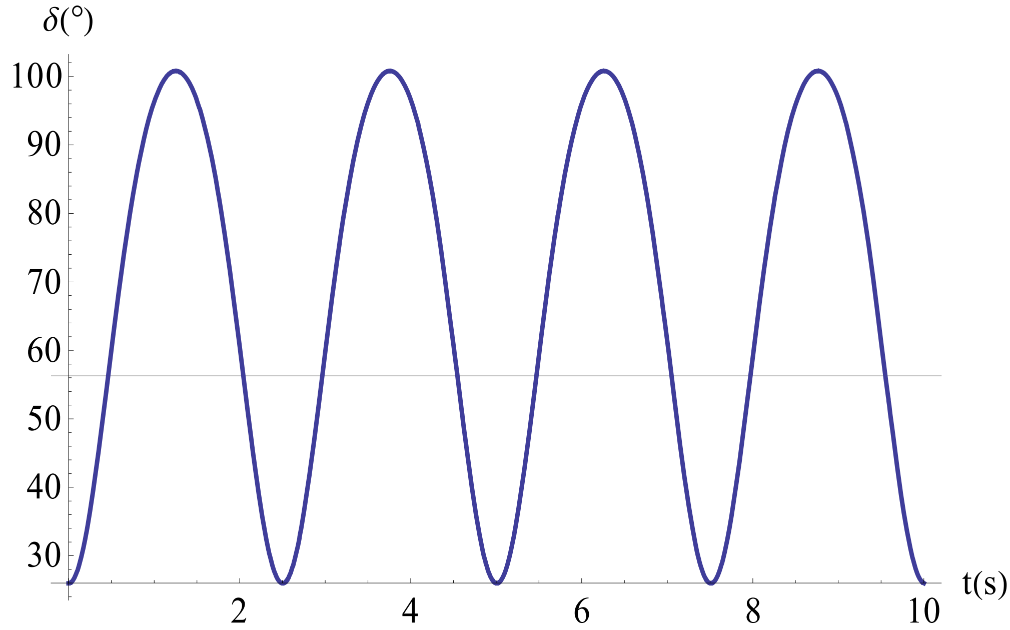
$$\omega(0) = \omega_0$$

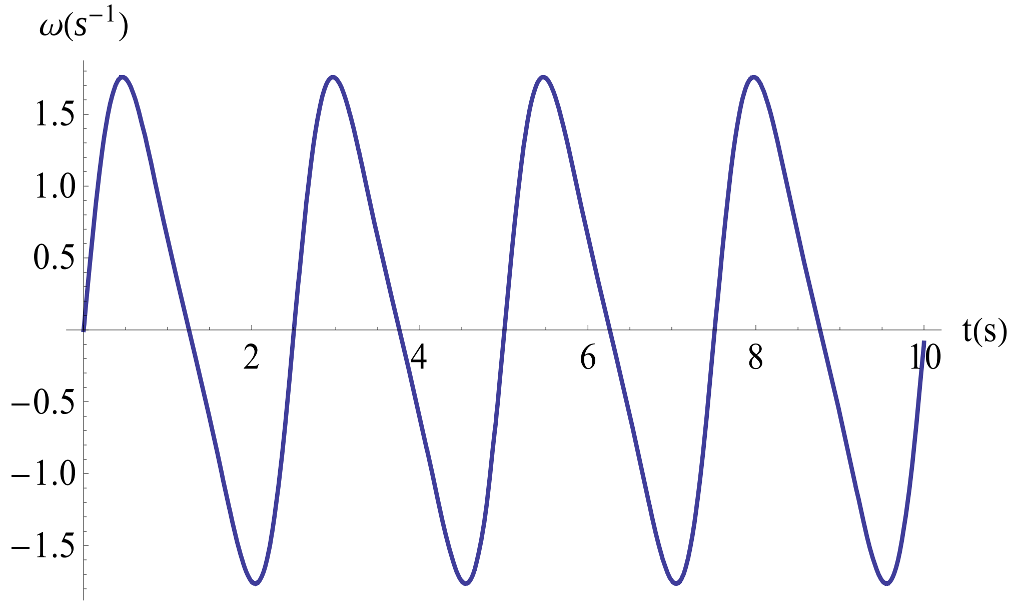
$P_{mech} = 1; \quad P_{max1} = 2{,}285; \quad P_{max2} = 1{,}939$



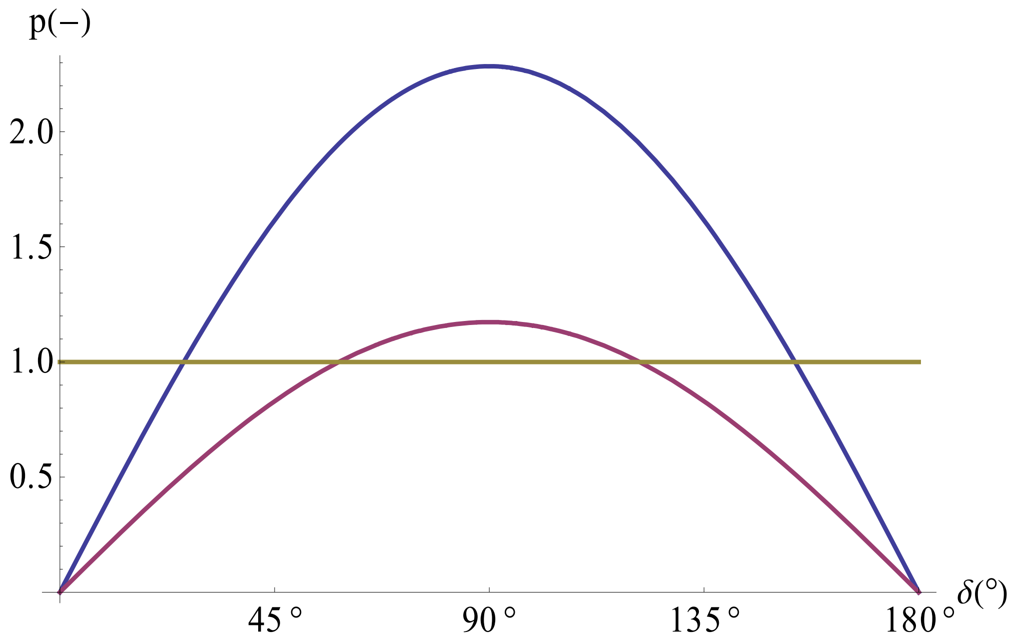
$P_{mech} = 1; \quad P_{max1} = 2,285; \quad P_{max2} = 0,62 \cdot 1,939 = 1,202$

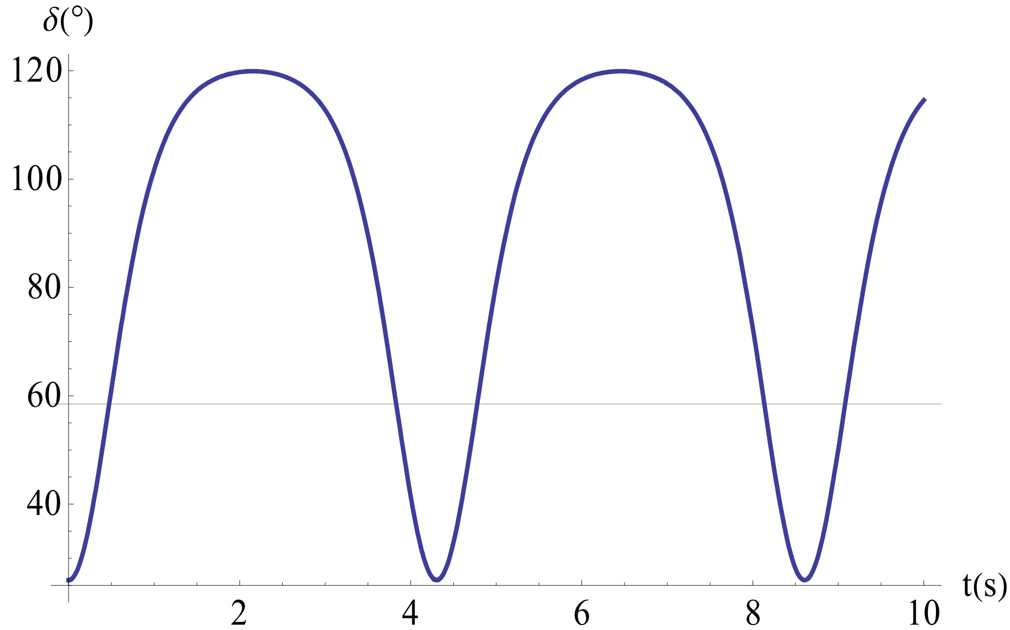


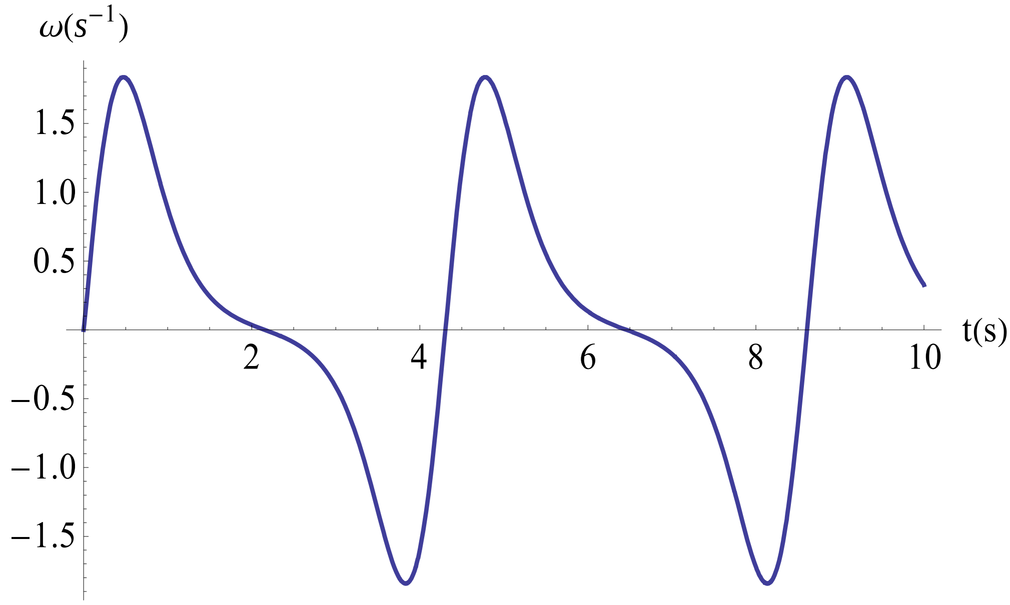




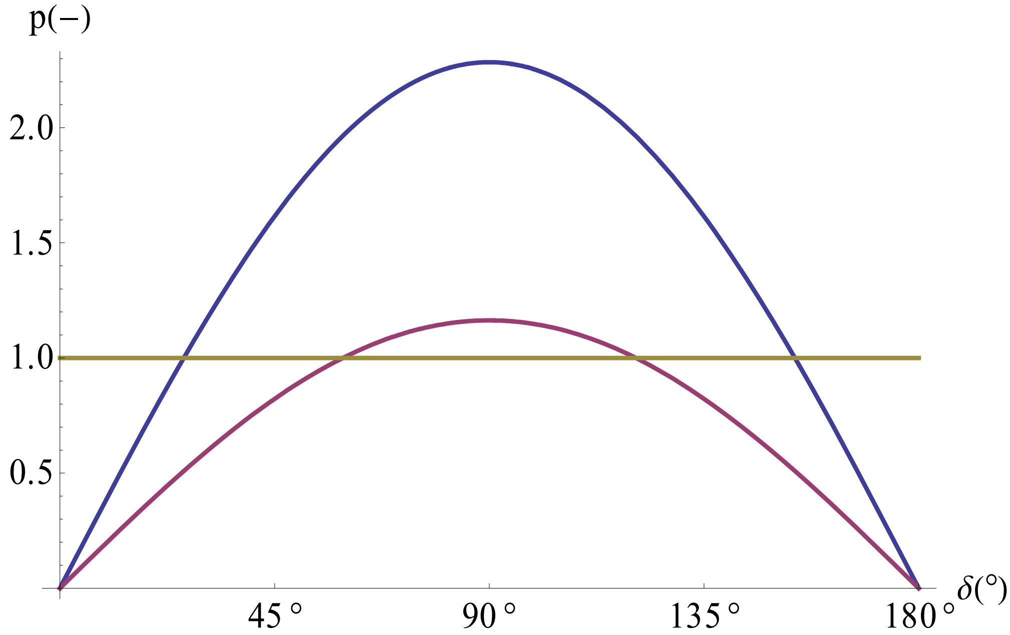
$P_{mech} = 1; \quad P_{max1} = 2{,}285; \quad P_{max2} = 0{,}605 \cdot 1{,}939 = 1{,}173$

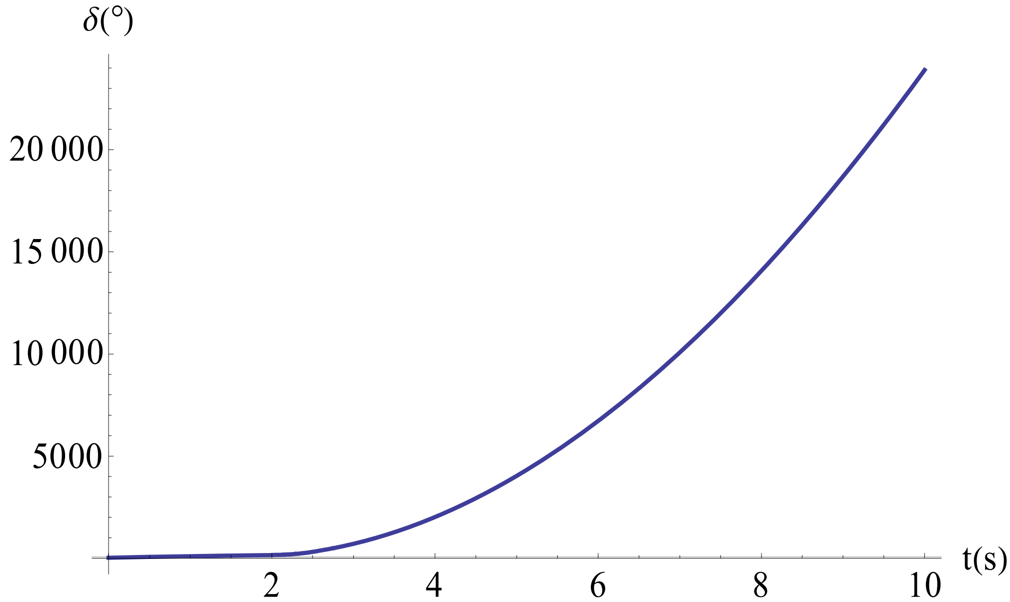


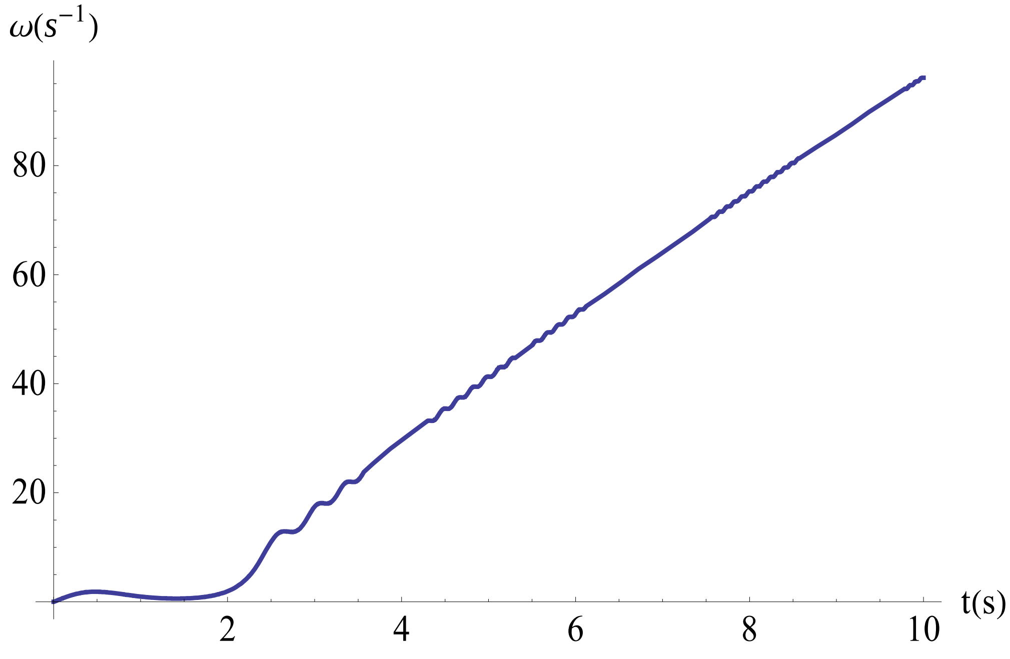




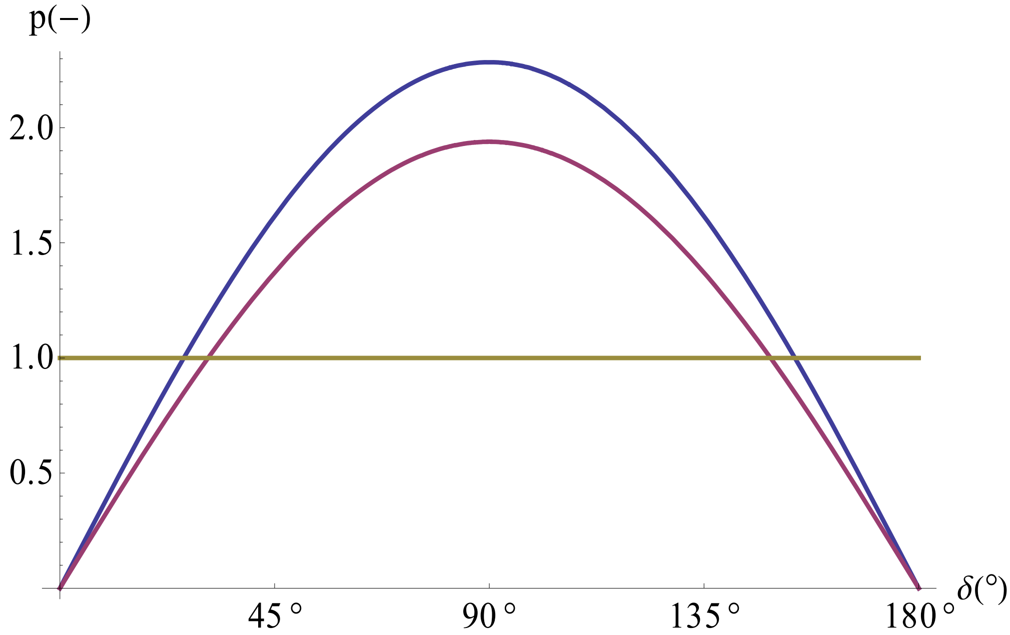
$P_{mech} = 1; \quad P_{max1} = 2{,}285; \quad P_{max2} = 0{,}6 \cdot 1{,}939 = 1{,}163$

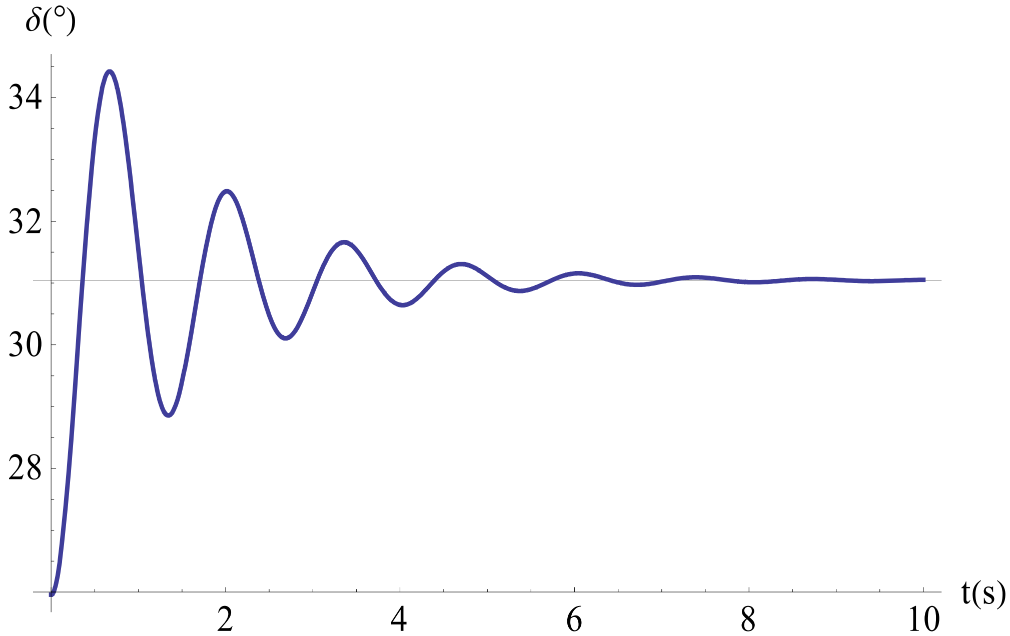


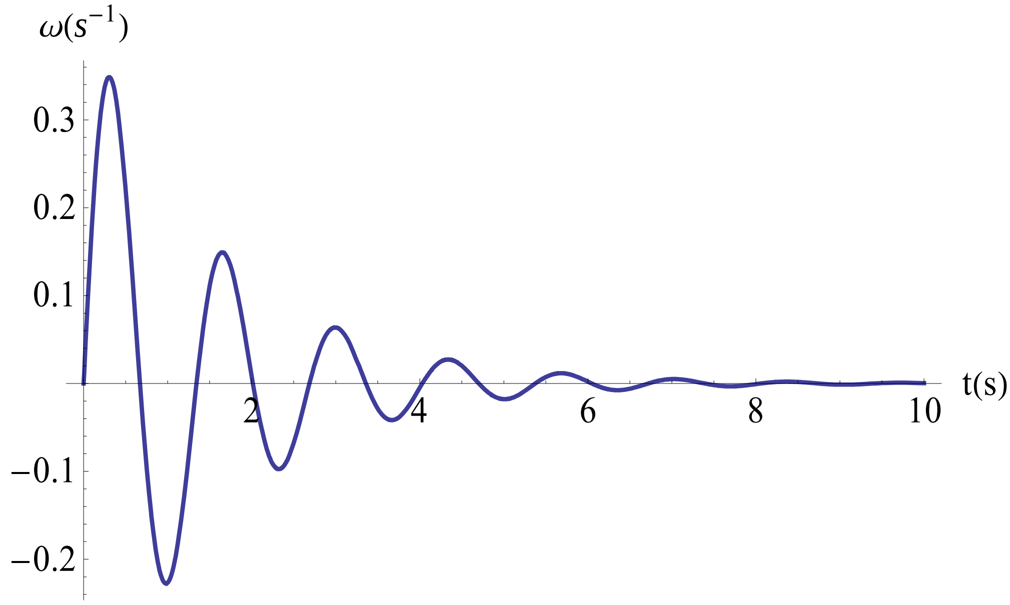




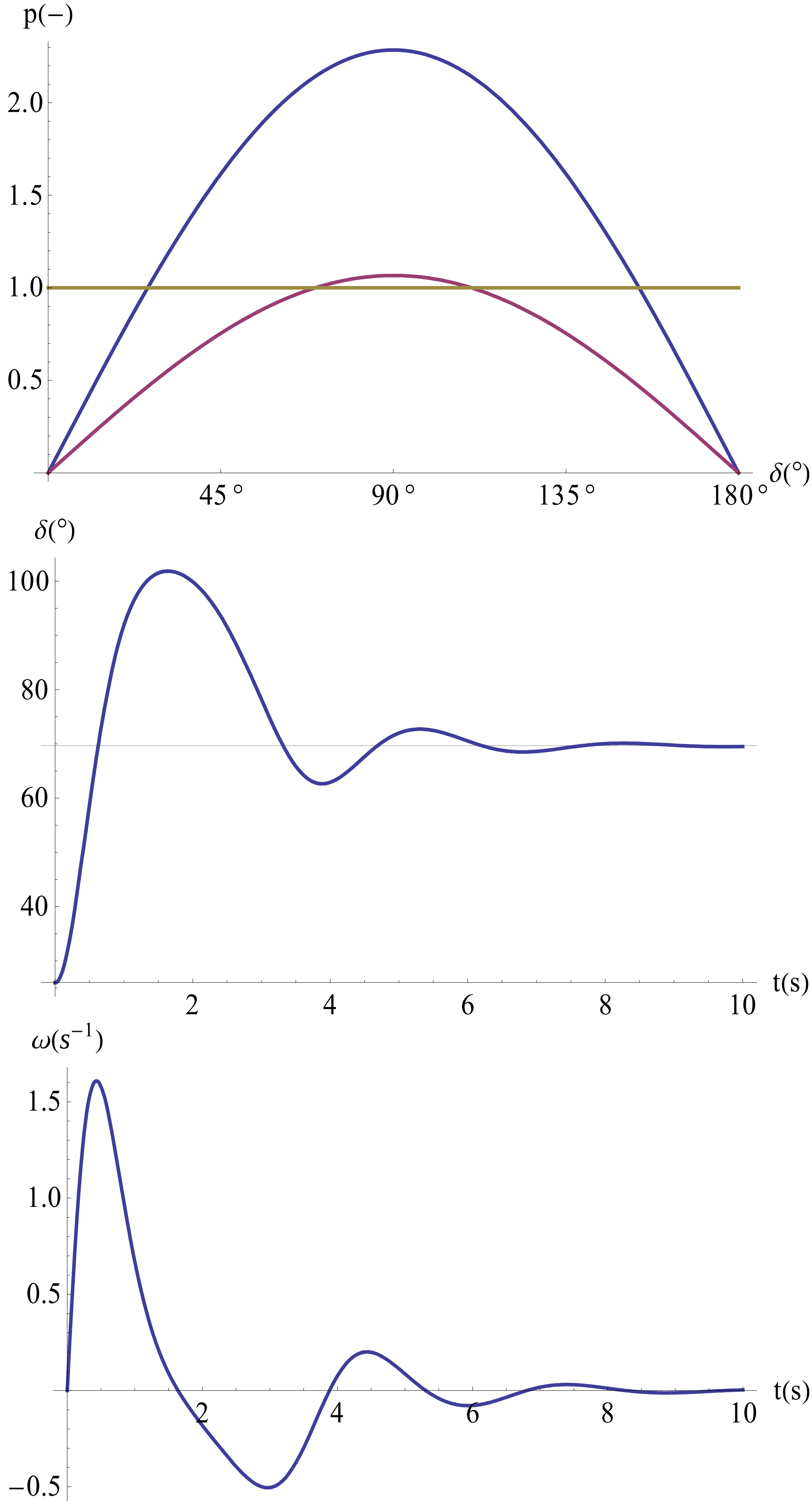
$P_{mech} = 1; \quad P_{\max 1} = 2{,}285; \quad P_{\max 2} = 1{,}939; \quad damping\ B = 0{,}0003$





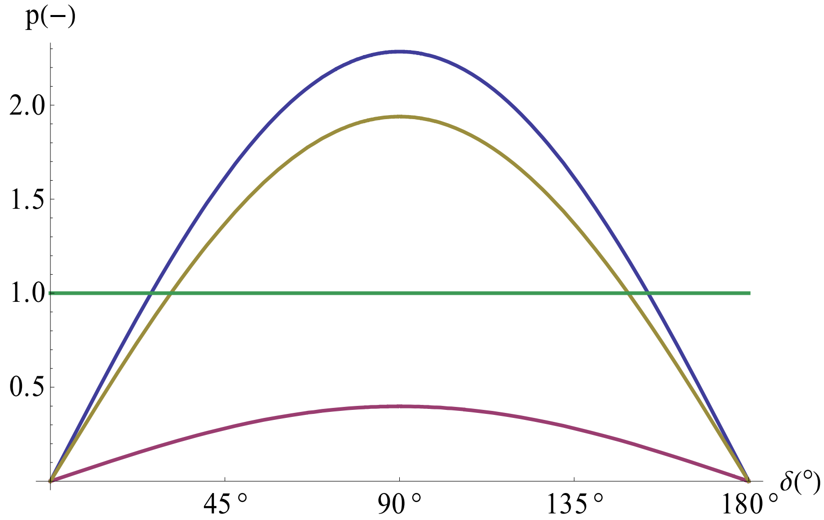


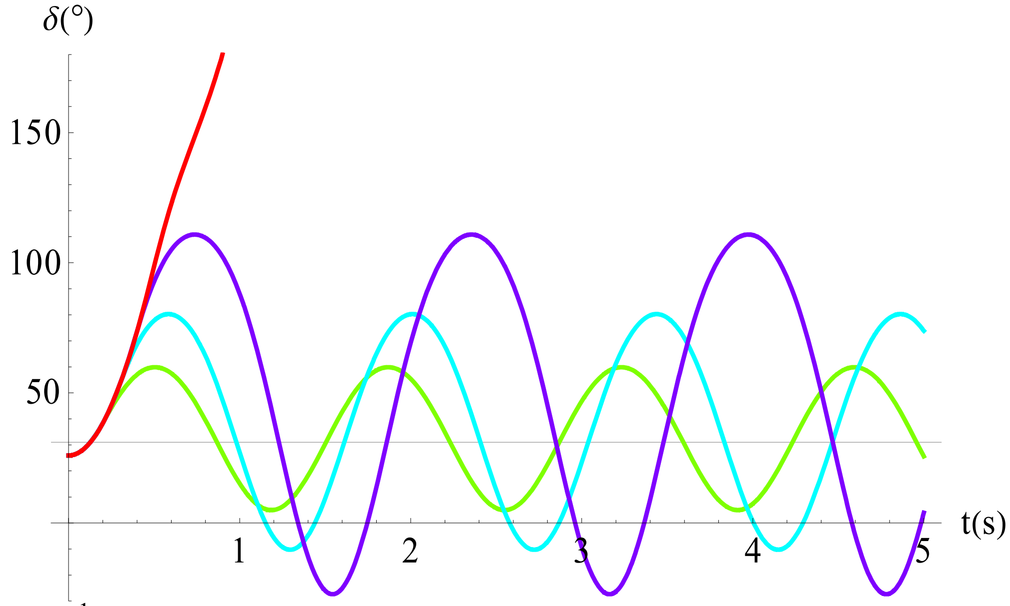
$P_{mech} = 1; \quad P_{\max 1} = 2{,}285; \quad P_{\max 2} = 0{,}55 \cdot 1{,}939 = 1{,}067; \quad damping\ B = 0{,}0003$

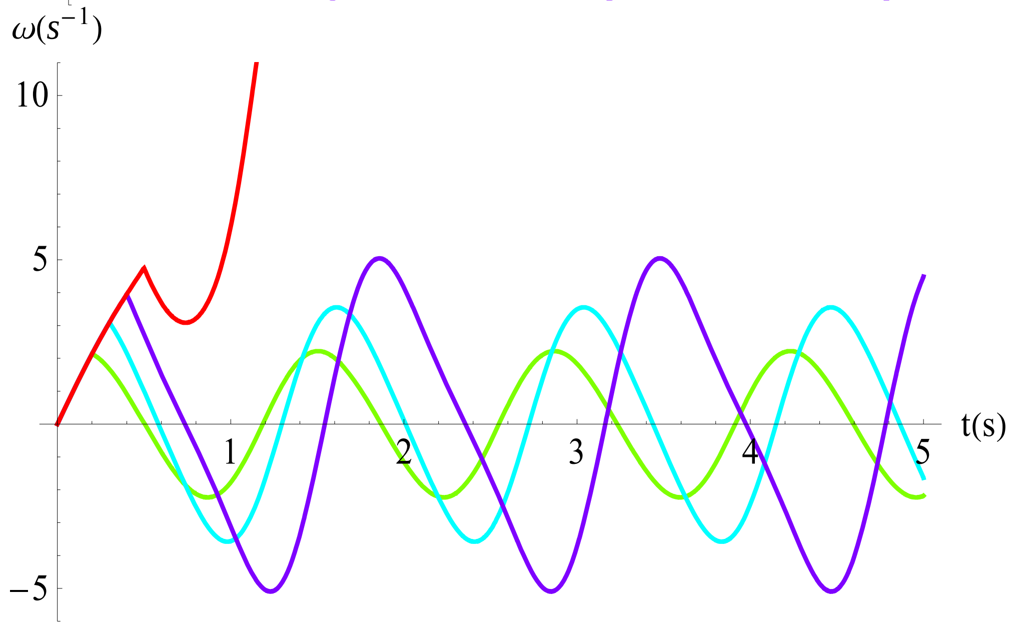


$P_{mech} = 1; \quad P_{max1} = 2{,}285; \quad P_{max2} = 1{,}939; \quad P_{max3} = 0{,}398$

Short-circuit switch-off: t_{vyp} = 0,5s 0,4s 0,3s 0,2s







$P_{mech} = 1; \quad P_{max1} = 2{,}285; \quad P_{max2} = 1{,}939; \quad P_{max3} = 0{,}398; \quad damping\ B = 0{,}0003$

Short-circuit switch-off: t_{vyp} = 0,5s 0,4s 0,3s 0,2s