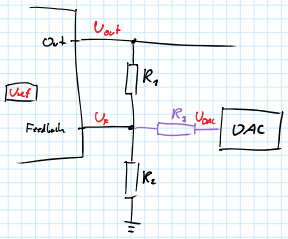
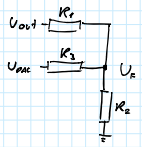
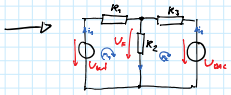
# Netzteil-Steuerung

Montag, 1. Februar 2016 09:14




$$M_1: \quad -U_{out} + R_1 \cdot i_1 + R_2 \cdot (i_1 + i_2) = 0$$

$$-U_{out} + R_1 \cdot i_1 + R_2 \cdot i_1 + R_2 \cdot i_2 = 0$$

$$-U_{out} + i_1 (R_1 + R_2) + i_2 \cdot R_2 = 0$$

$$i_2 \cdot R_2 = U_{out} - i_1 (R_1 + R_2)$$

$$i_2 = \frac{U_{out} - i_1 (R_1 + R_2)}{R_2}$$

$$M_2: \quad U_{DAC} - R_2 \cdot (i_1 + i_2) - R_3 \cdot i_2 = 0$$

$$U_{DAC} - R_2 \cdot i_1 + R_2 \cdot i_2 - R_3 \cdot i_2 = 0$$

$$U_{DAC} - i_1 \cdot R_2 + i_2 (R_2 - R_3) = 0$$

$i_2$ einsetzen, nach $i_1$ auflösen

$$U_{DAC} - i_1 \cdot R_2 + \frac{U_{out} - i_1 (R_1 + R_2)}{R_2} \cdot (R_2 - R_3) = 0$$

$$U_{DAC} - i_1 \cdot R_2 + U_{out} - i_1 (R_1 + R_2) - R_3 \left( \frac{U_{out} - i_1 (R_1 + R_2)}{R_2} \right) = 0$$

$$U_{DAC} - i_1 \cdot R_2 + U_{out} - i_1 (R_1 + R_2) - \frac{R_3}{R_2} \cdot U_{out} - i_1 \left( \frac{R_1 R_3}{R_2} + R_3 \right) = 0$$

$$U_{DAC} + U_{out} \left(1 - \frac{R_3}{R_2}\right) - i_1 \left( R_2 + R_1 + R_2 + \frac{R_1 R_3}{R_2} + R_3 \right) = 0$$

$$i_1 \left( R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2} \right) = U_{DAC} + U_{out} \left(1 - \frac{R_3}{R_2}\right)$$

$$i_1 = \frac{U_{DAC} + U_{out} \left(1 - \frac{R_3}{R_2}\right)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}}$$

$$i_2 = \frac{U_{out} - i_1 (R_1 + R_2)}{R_2}$$

$$= \frac{U_{out} - \frac{U_{DAC} + U_{out} \left(1 - \frac{R_3}{R_2}\right)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \cdot (R_1 + R_2)}{R_2}$$

$$= \frac{U_{out}}{R_2} - \frac{U_{DAC} + U_{out} \left(1 - \frac{R_3}{R_2}\right)}{R_1 R_2 + R_2 R_3 + R_1 R_3 + 2R_2^2} \cdot (R_1 + R_2)$$

$$U_F = (i_1 + i_2) R_2$$

$$= \left( \frac{U_{DAC} + U_{out} \left(1 - \frac{R_3}{R_2}\right)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} + \frac{U_{out} - \frac{U_{DAC} + U_{out} \left(1 - \frac{R_3}{R_2}\right)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \cdot (R_1 + R_2)}{R_2} \right) \cdot R_2$$

$$= \frac{R_2 U_{DAC} + U_{out} (R_2 - R_3)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} + U_{out} - \frac{U_{DAC} + U_{out} \left(1 - \frac{R_3}{R_2}\right)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \cdot (R_1 + R_2)$$

$$= U_{DAC} \cdot \frac{R_2}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} + \frac{U_{out} (R_2 - R_3)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} + U_{out} - U_{DAC} \cdot \frac{R_1 + R_2}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} - U_{out} \cdot \frac{\left(1 - \frac{R_3}{R_2}\right) \cdot (R_1 + R_2)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}}$$

$$= U_{DAC} \cdot \left( \frac{R_2}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} - \frac{R_1 + R_2}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \right) + U_{out} \left( 1 + \frac{R_2 - R_3}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} - \frac{\left(1 - \frac{R_3}{R_2}\right) \cdot (R_1 + R_2)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \right)$$

$$= U_{DAC} \cdot \left( \frac{R_1}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \right) + U_{out} \left( 1 + \frac{R_2 - R_3}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} - \frac{\left(1 - \frac{R_3}{R_2}\right) \cdot (R_1 + R_2)}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \right)$$

$$\left(1 - \frac{R_3}{R_2}\right) \cdot (R_1 + R_2)$$

$$= R_1 + R_2 - \frac{R_1 R_3}{R_2} - R_3$$

$$= R_2 - R_3 + R_1 - \frac{R_1 R_3}{R_2}$$

$$= U_{DAC} \cdot \left( \frac{R_1}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \right) + U_{out} \left( 1 + \frac{R_1 - \frac{R_1 R_3}{R_2}}{R_1 + 2R_2 + R_3 + \frac{R_1 R_3}{R_2}} \right)$$

Bsp. $R_1 = R_2 = R_3 = 1\Omega$

$$U_{DAC} \cdot \left( \frac{1}{1+2+1+1} \right) + U_{out} \left( 1 + \frac{1-1}{\dots} \right)$$

$$U_F = \frac{1}{5} U_{DAC} + U_{out}$$