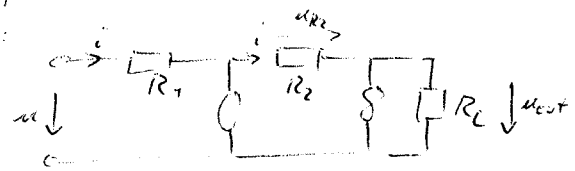
Aufgabe 14

- Op-Amp im linearen Bereich:

ESB:



$u = R_1 i \qquad u_{R_2} = R_2 i = \frac{R_2}{R_1} u$

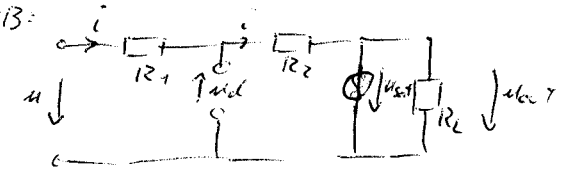
$u_{out} = -u_{R_2} = -\frac{R_2}{R_1} u$

Gültigkeitsbereich: $|u_{out}| \leq U_{sat}$

$|u| \leq \frac{R_1}{R_2} U_{sat}$

- Op-Amp im positiven Sättigungsbereich

ESB:



$u = (R_1 + R_2) i + U_{sat} \qquad u_{out} = U_{sat}$

Gültigkeitsbereich: $u_d > 0$

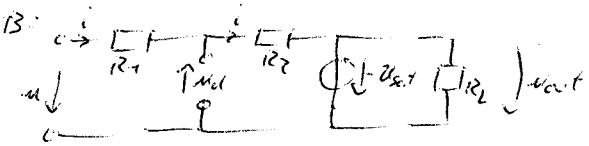
$u_d = -U_{sat} - R_2 i = -U_{sat} - R_2 \frac{u - U_{sat}}{R_1 + R_2} > 0$

$-\frac{R_2}{R_1+R_2} u > U_{sat} \frac{R_1}{R_1+R_2}$

$u < -\frac{R_1}{R_2} U_{sat}$

- Op-Amp im negativen Sättigungsbereich

ESB:



$u = (R_1 + R_2) i - U_{sat} \qquad u_{out} = -U_{sat}$

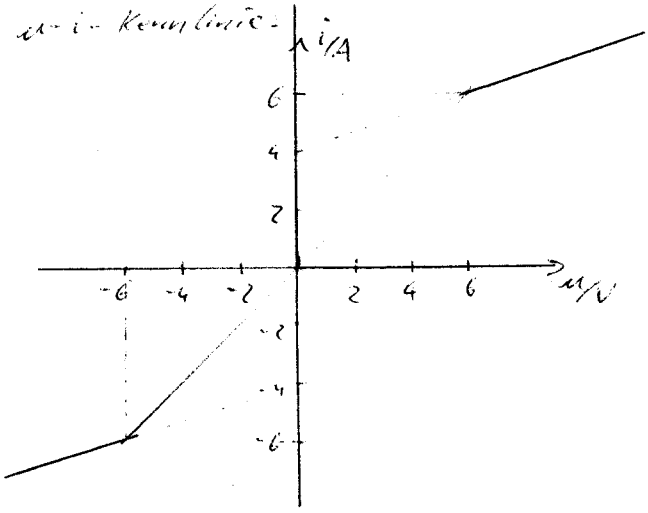
Gültigkeitsbereich: $u_d < 0$

$u_d = U_{sat} - R_2 i = U_{sat} - R_2 \frac{u + U_{sat}}{R_1 + R_2} < 0$

$-\frac{R_2}{R_1+R_2} u < \frac{R_2}{R_1+R_2} U_{sat} - U_{sat} = \frac{-R_1}{R_1+R_2} U_{sat}$

$u > \frac{R_1}{R_2} U_{sat}$

u-i-Kennlinie:



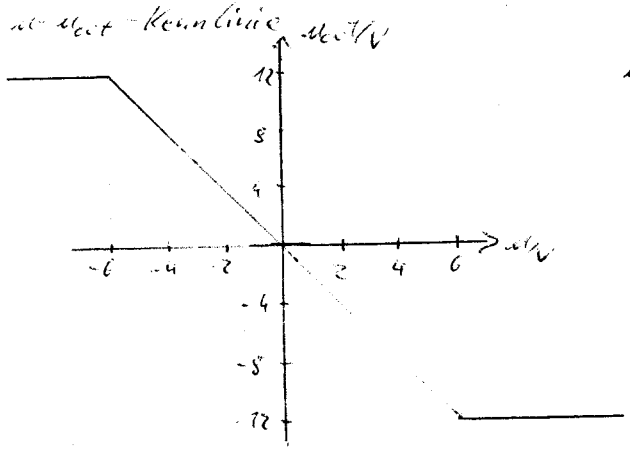
$i = \frac{u}{R_1} = \frac{u}{1\Omega}$ für $|u| \leq \frac{R_1}{R_2} U_{Sat} = 6V$

$i = \frac{u - 12V}{3\Omega} = \frac{u}{3\Omega} - 4A$

für $u < -\frac{1}{2} U_{Sat}$

$i = \frac{u + 12V}{3\Omega}$

u-u_{out}-Kennlinie



$u_{out} = -\frac{R_2}{R_1} u = -2u$

für $|u| \leq 6V$

$u_{out} = U_{Sat}$ für $u < -6V$

$u_{out} = -U_{Sat}$ für $u > 6V$