

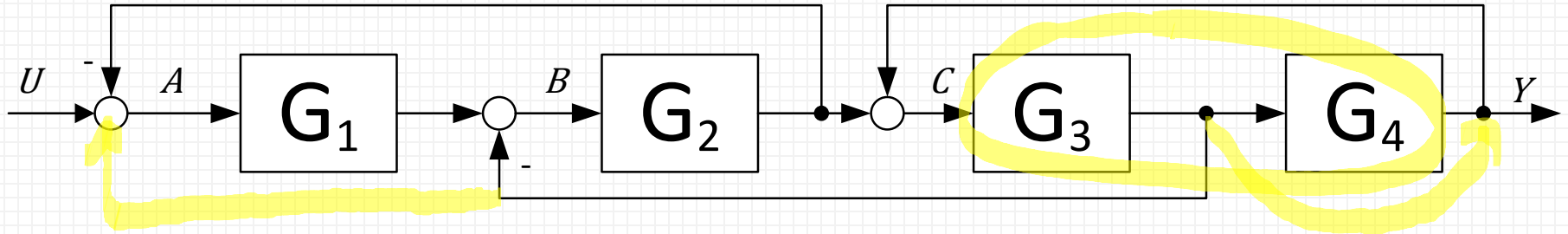


7. Übung zur Vorlesung Steuer- und Regelungstechnik

BLOCKSCHALTBILDER IM LAPLACE BEREICH

15. JANUAR 2018

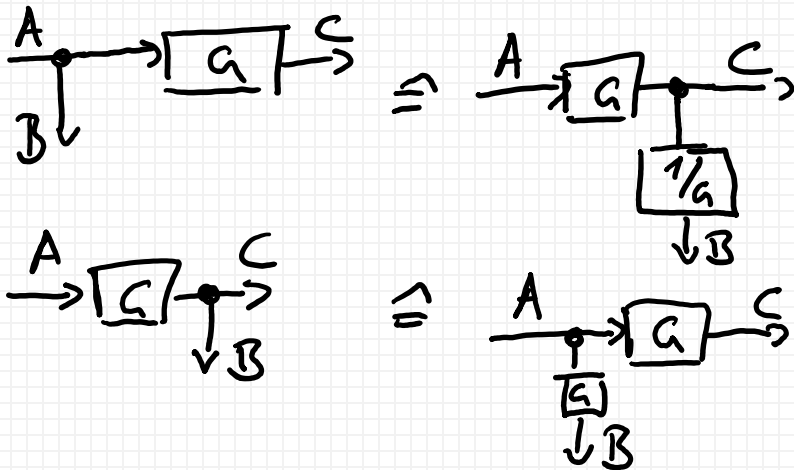
Aufgabe 7.1 - Umformung



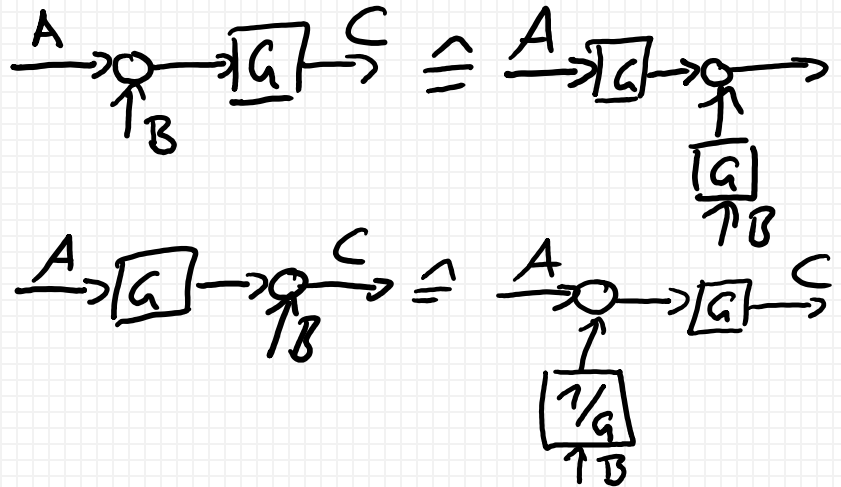
Vorgehen: Reihenschaltung
 Parallelschaltung
 Rückkopplung } zusammenfassen

Notw. Tricks:

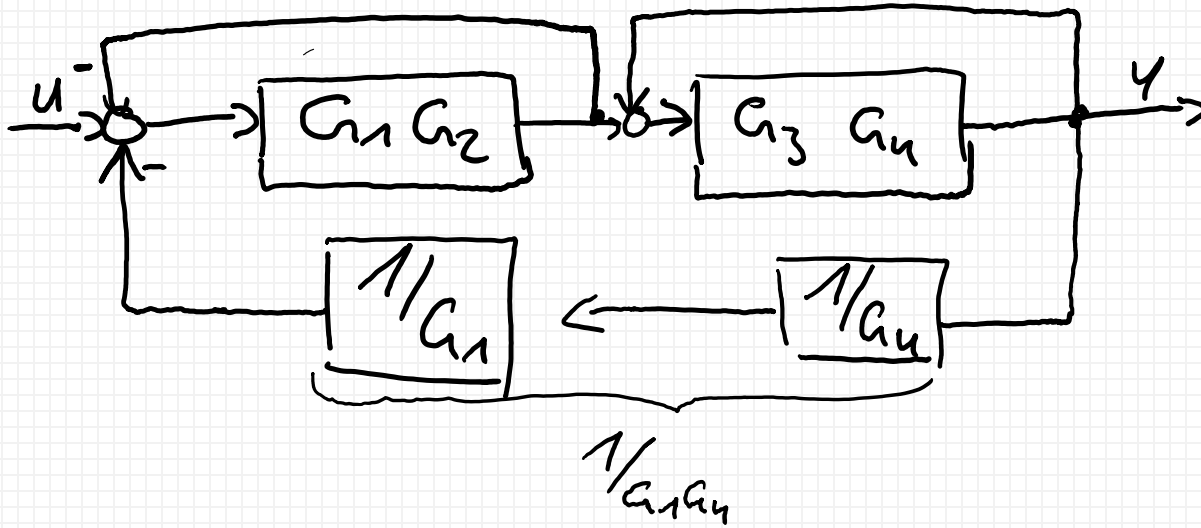
Verzweigung



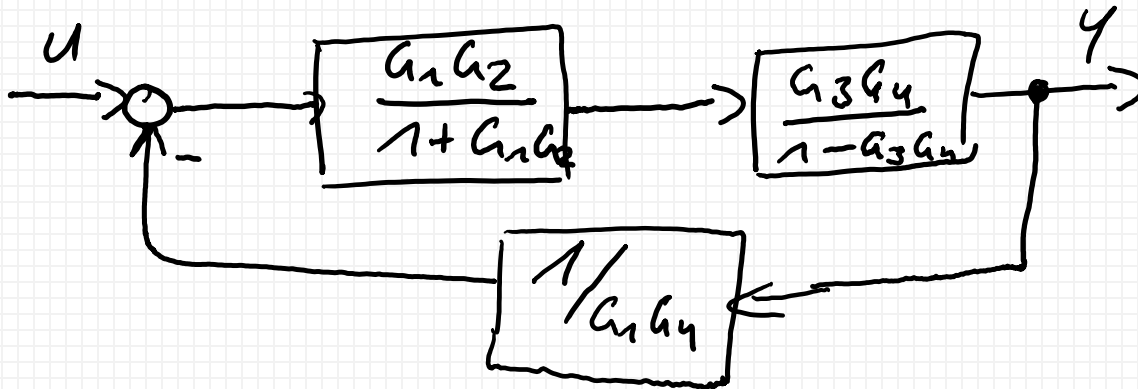
Summation



Aufgabe 7.1 - Umformung

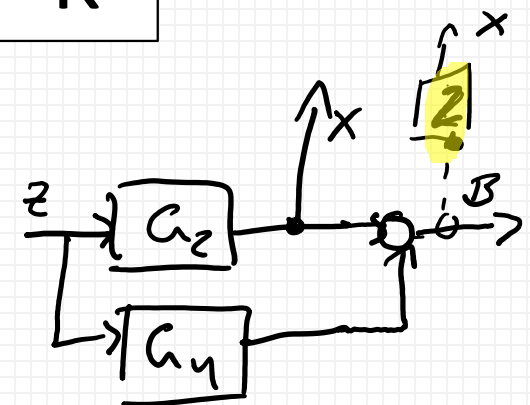
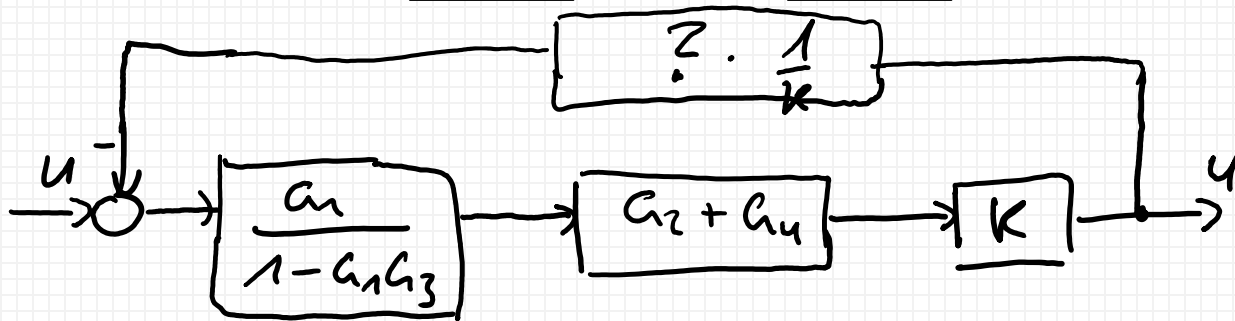
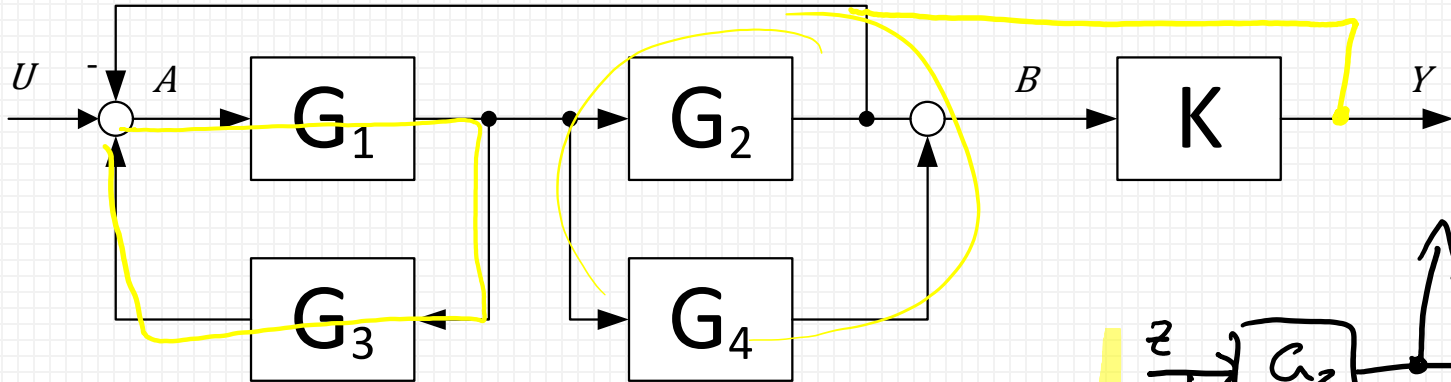


$$G = \frac{y}{u} = \frac{\frac{G_1 G_2}{1 + G_1 G_2} \cdot \frac{G_3 G_4}{1 - G_3 G_4}}{1 + \frac{G_1 G_2}{1 + G_1 G_2} \cdot \frac{G_3 G_4}{1 - G_3 G_4} \cdot \frac{1}{G_1 G_4}}$$



$$= \frac{G_1 G_2 G_3 G_4}{(1 + G_1 G_2)(1 - G_3 G_4) + G_2 G_3}$$

Aufgabe 7.2 - Umformung



$$X = G_2 \cdot Z$$

$$B = G_4 \cdot Z + G_2 \cdot Z$$

$$B \cdot ? = X$$

$$(G_4 + G_2) Z \cdot ? = G_2 \cdot Z$$

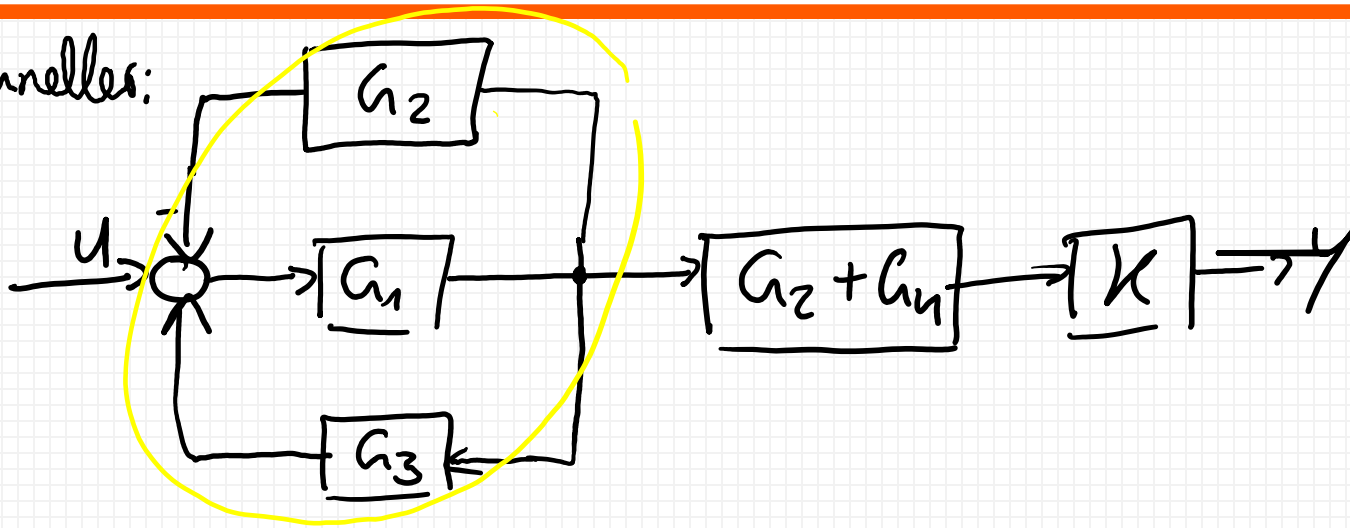
$$? = \frac{G_2}{G_4 + G_2}$$

Theoretisch richtig,
aber Nebenrechnung
nötig
⇒ unverständlich

Aufgabe 7.2 - Umformung



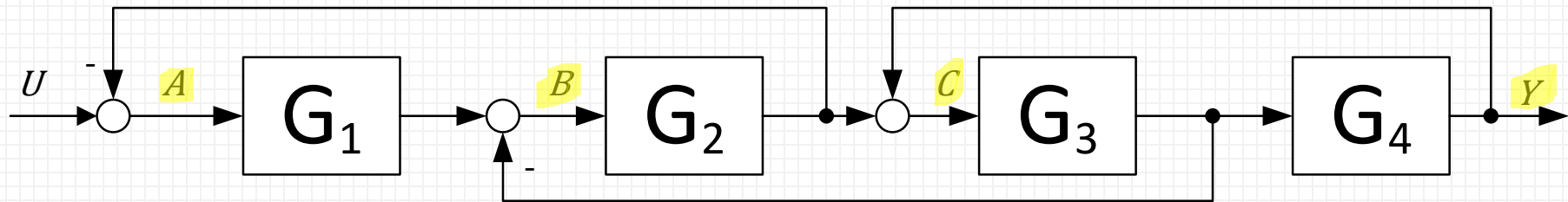
Schnelles:



$$\frac{G_1}{1 - G_1(G_3 - G_2)}$$

$$G = \frac{y}{u} = \frac{K \cdot (G_2 + G_1) \cdot G_1}{1 - G_1(G_3 - G_2)}$$

Aufgabe 7.1 - Algebraisch



Hilfssignale (z.B. Summationspunkten)

Lösen eines Al.sys.

$$Y = G_4 G_3 \cdot C \quad (1)$$

$$C = Y + G_2 \cdot B \quad (2)$$

$$B = -G_3 C + G_1 \cdot A \quad (3)$$

$$A = U - G_2 \cdot B \quad (4)$$

(4) in (3)

$$B = -G_3 C + G_1 (U - G_2 B)$$

$$(G_1 G_2 + 1) B = -G_3 C + G_1 U$$

$$B = \frac{-G_3}{G_1 G_2 + 1} C + \frac{G_1}{G_1 G_2 + 1} U$$

In (2)

...

Aufgabe 7.1 - Algebraisch

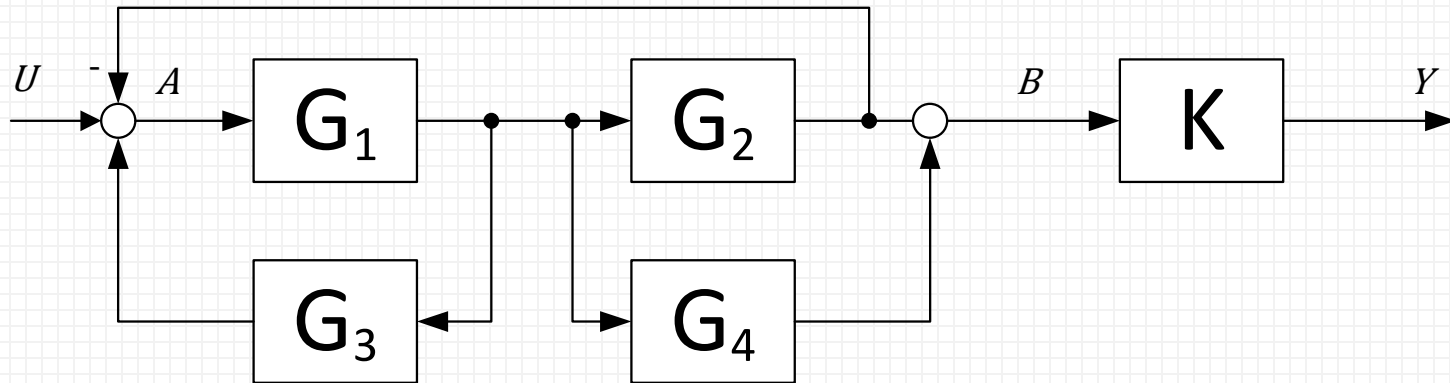


$$C = \frac{1 + a_1 a_2}{1 + a_1 a_2 + a_2 a_3} Y + \frac{a_1 a_2}{1 + a_1 a_2 + a_2 a_3} U$$

In (1)

$$a = \frac{Y}{U} = \frac{a_1 a_2 a_3 a_4}{(1 + a_1 a_2)(1 - a_3 a_4) + a_2 a_3}$$

Aufgabe 7.2 - Algebraisch



$$Y = K \cdot B \quad (1)$$

$$B = G_4 \cdot G_1 \cdot A + G_2 \cdot G_1 \cdot A = G_1 \cdot (G_4 + G_2) \cdot A$$

$$A = U + G_1 \cdot G_3 \cdot A - G_1 G_2 A$$

$$(1 + G_1 G_2 - G_1 G_3) A = U$$

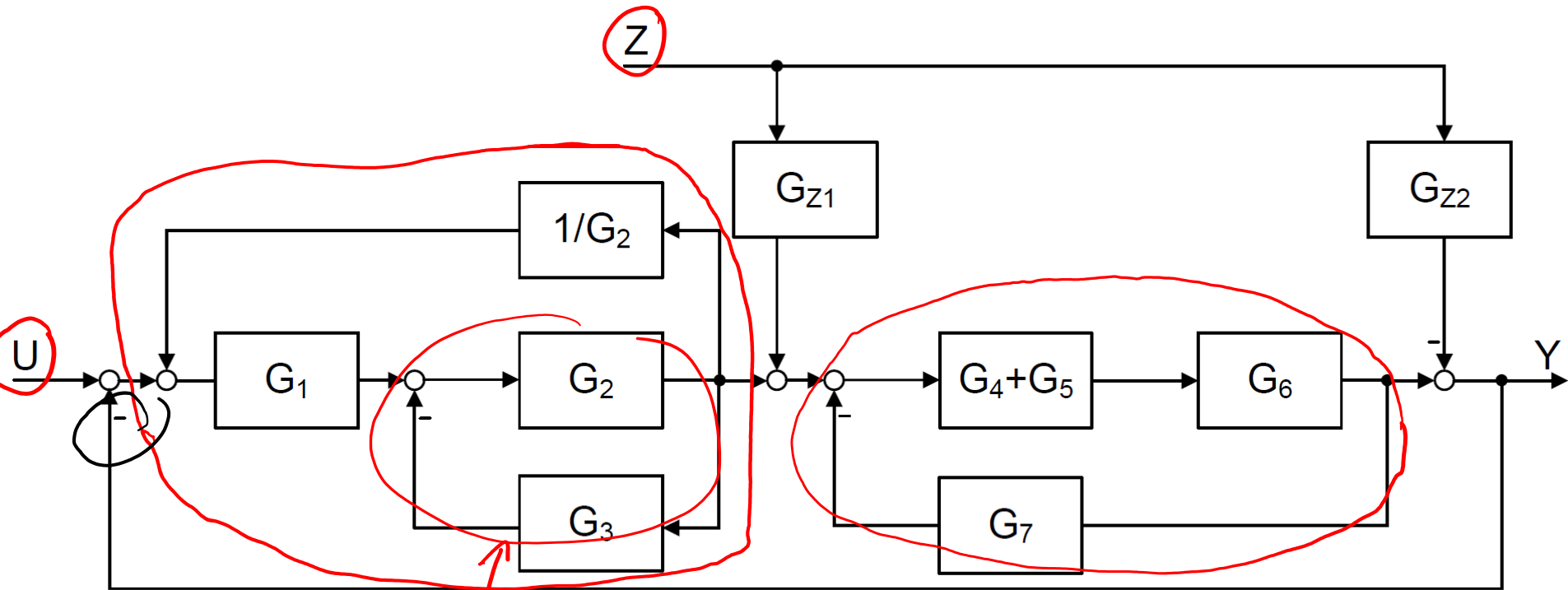
$$A = \frac{U}{1 + G_1(G_2 - G_3)}$$

Aufgabe 7.2 - Algebraisch



$$G = \frac{y}{u} = \frac{\kappa a_1 (a_2 + a_n)}{1 + a_1 (a_2 - a_3)} u$$

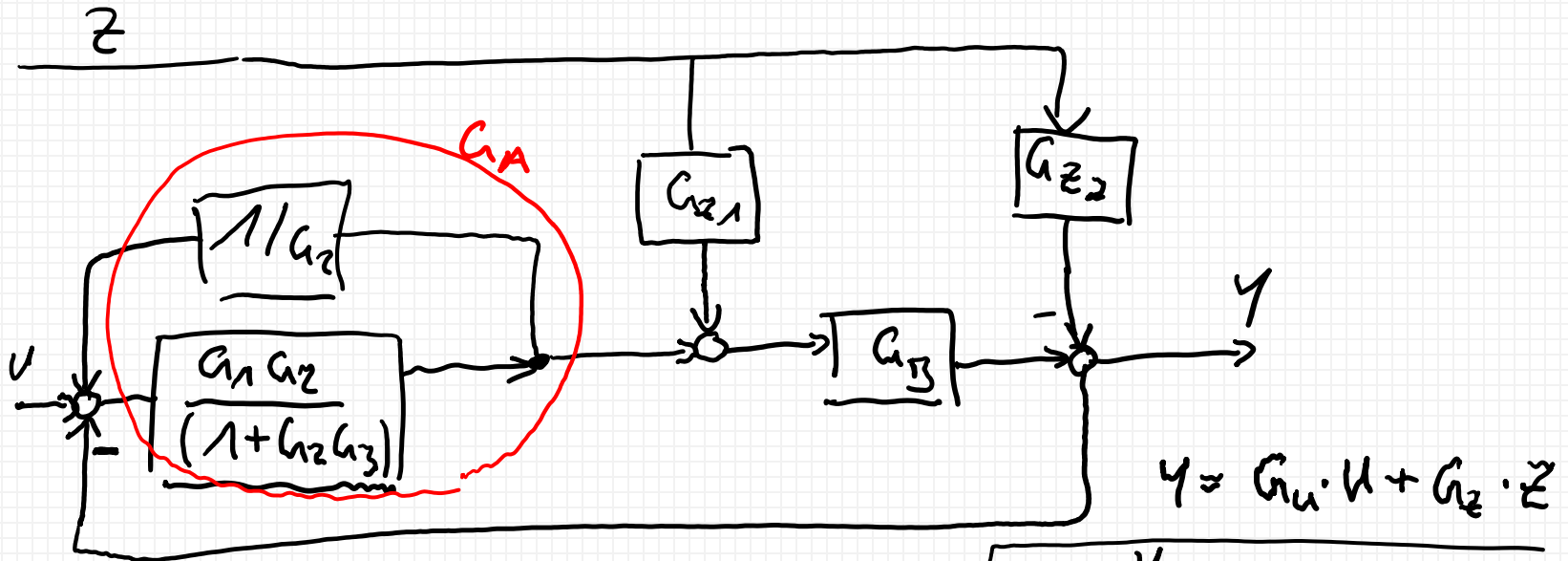
Aufgabe 7.3



$$\frac{G_2}{1 + G_2 G_3}$$

$$\frac{(G_4 + G_5) G_6}{1 + (G_4 + G_5) G_6 \cdot G_7} = G_B$$

Aufgabe 7.3



$$G_A = \frac{\frac{G_1 G_2}{1 + G_2 G_3}}{1 - \frac{1}{G_2} \frac{G_1 G_2}{1 + G_2 G_3}} = \frac{G_1 G_2}{1 + G_2 G_3 - G_1}$$

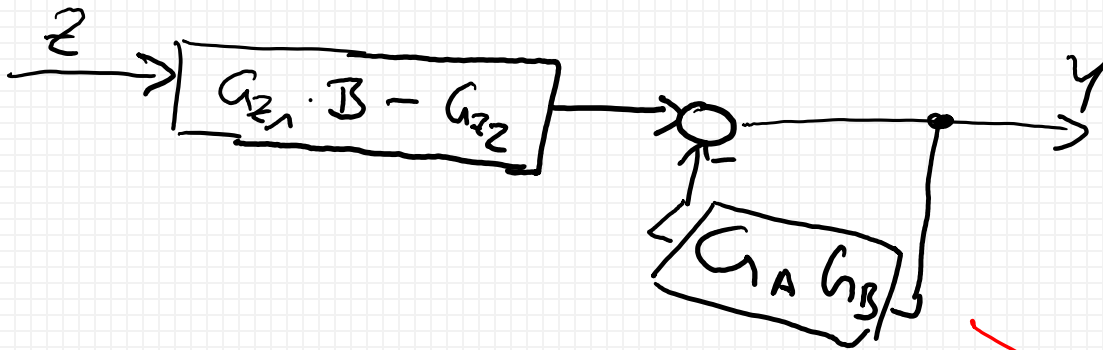
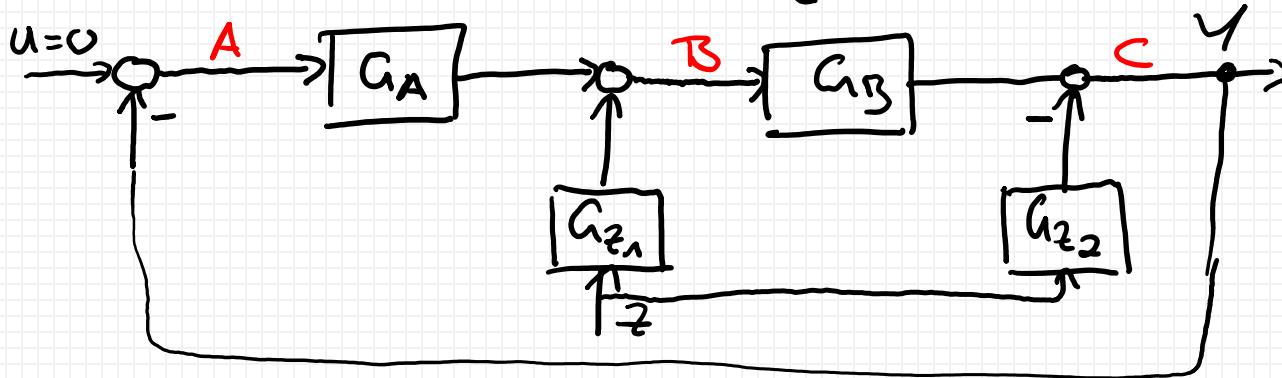
$$G_u = \frac{Y}{U} : Z = 0$$

$$G_u = \frac{G_A G_3}{1 + G_A G_3}$$

Aufgabe 7.3



Störübertragungsfunktion $G_z = \frac{Y}{Z} : U=0$



$$Y = C$$

$$C = G_B B - G_{z2} \cdot Z$$

$$B = G_{z1} \cdot Z + G_A \cdot A$$

$$A = -C$$

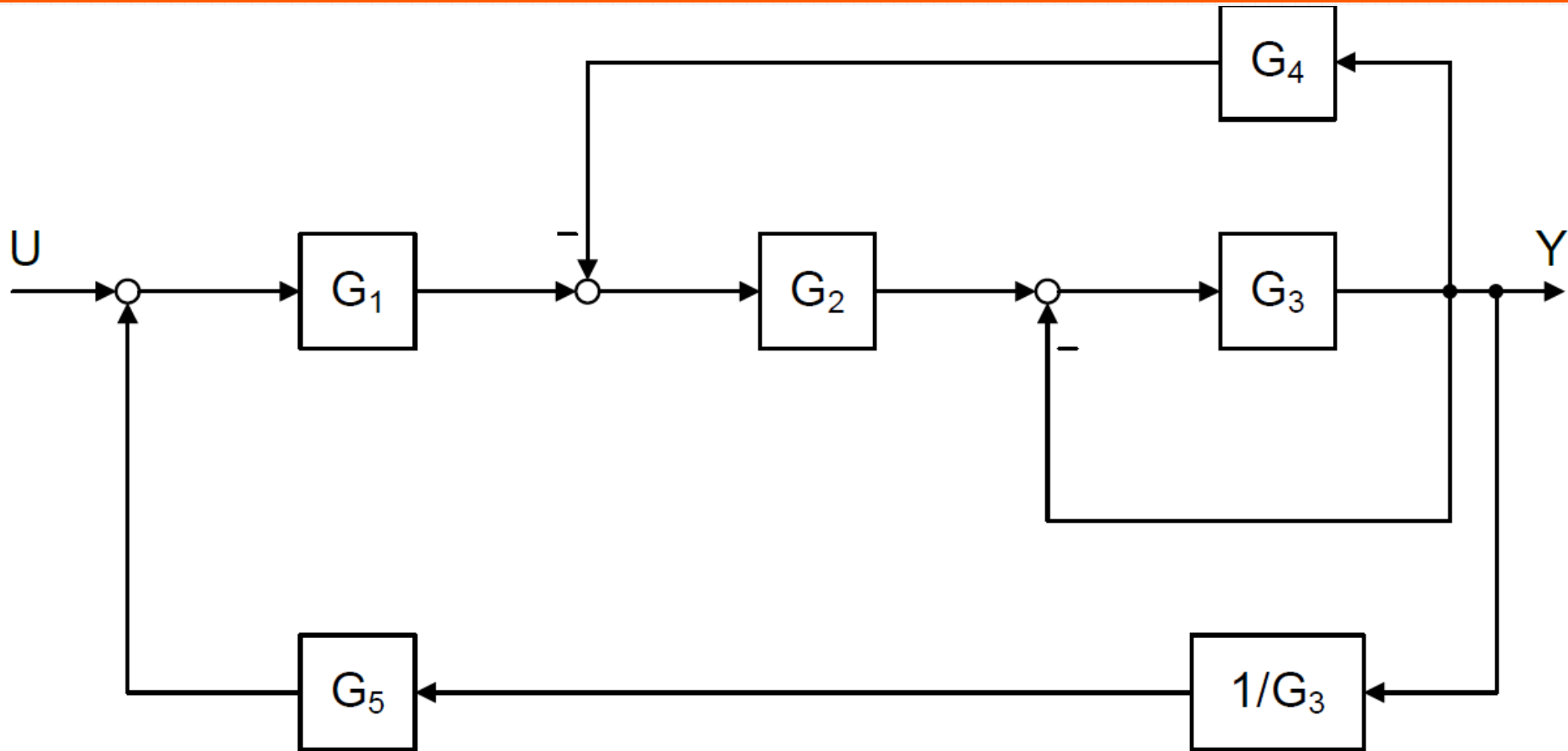
$$B = G_{z1} \cdot Z - G_A C$$

$$C = G_B G_{z1} Z - G_B G_A C - G_{z2} \cdot Z$$

$$(1 + G_B G_A) C = (G_B G_{z1} - G_{z2}) Z$$

$$G_z = \frac{Y}{Z} = \frac{G_B G_{z1} - G_{z2}}{1 + G_B G_A}$$

Aufgabe 7.4



Selbststudium