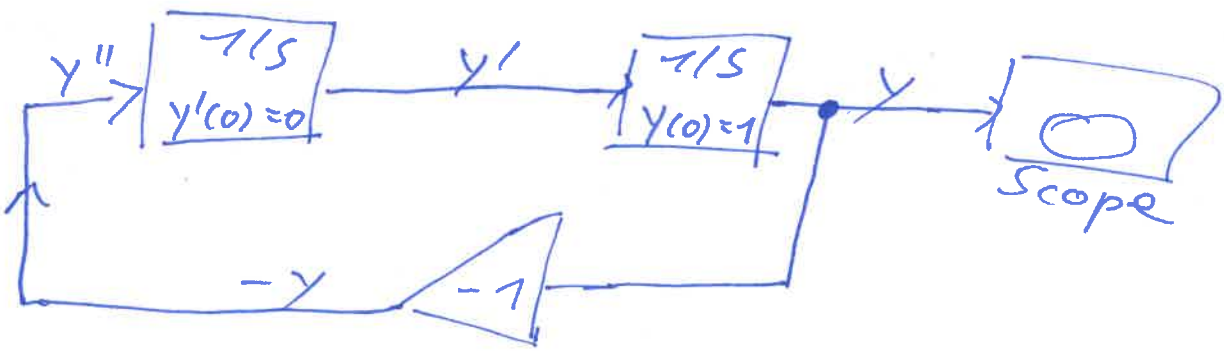
DGL's in Simulink

(1) $\frac{d^2 y(t)}{dt^2} + y(t) = 0 \Rightarrow y'' = -y$

- Ordnung: 2 → 2 Integratoren
  2 Anfangsbed.

$y(0) = 1$ ("Auslenkung")

$\frac{dy}{dt}(0) = 0$ ("in Ruhe")

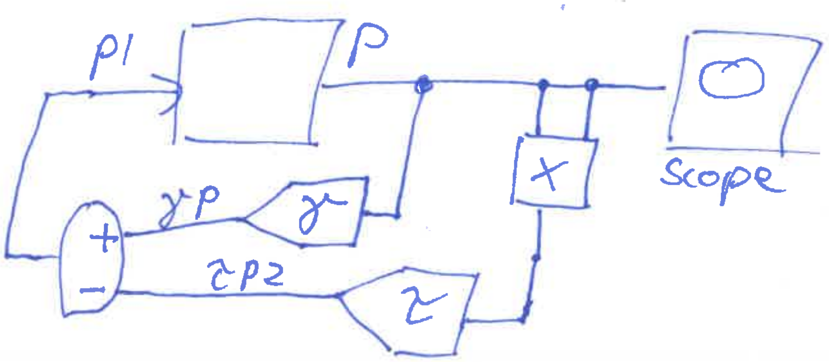


(2) Logistische Gleichung:

$$\frac{dP(t)}{dt} - \gamma P(t) + \tau \underbrace{P^2(t)}_{\text{nichtlinear}} = 0$$

Ordnung 1

$P' = \gamma P - \tau P^2$

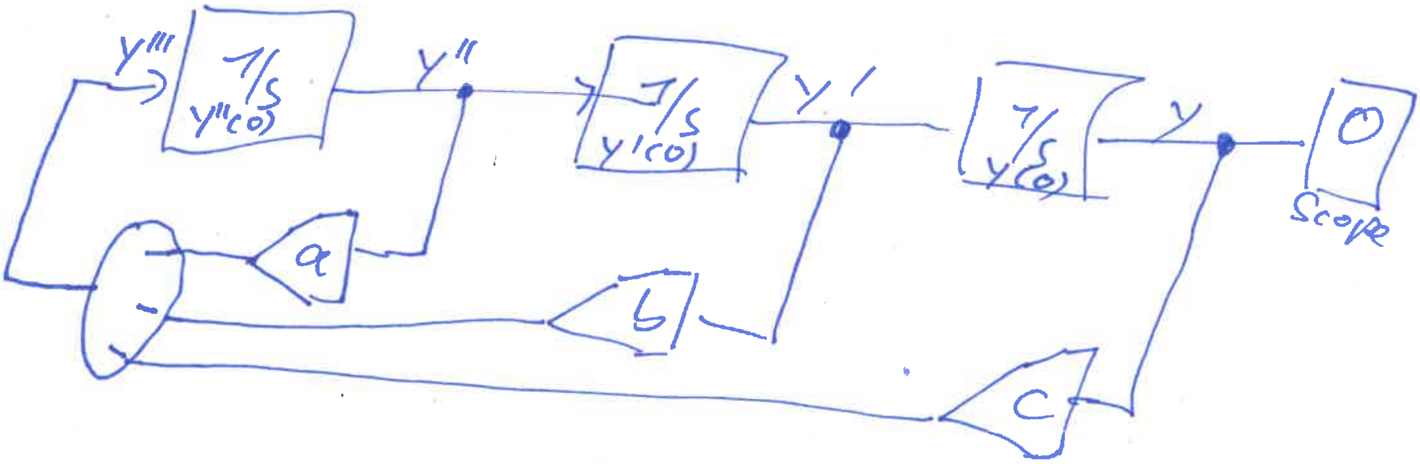


Grenzbedingung $0 = P' = \gamma P - \tau P^2 \mid :P$

$P_{Limit} = \gamma / \tau$

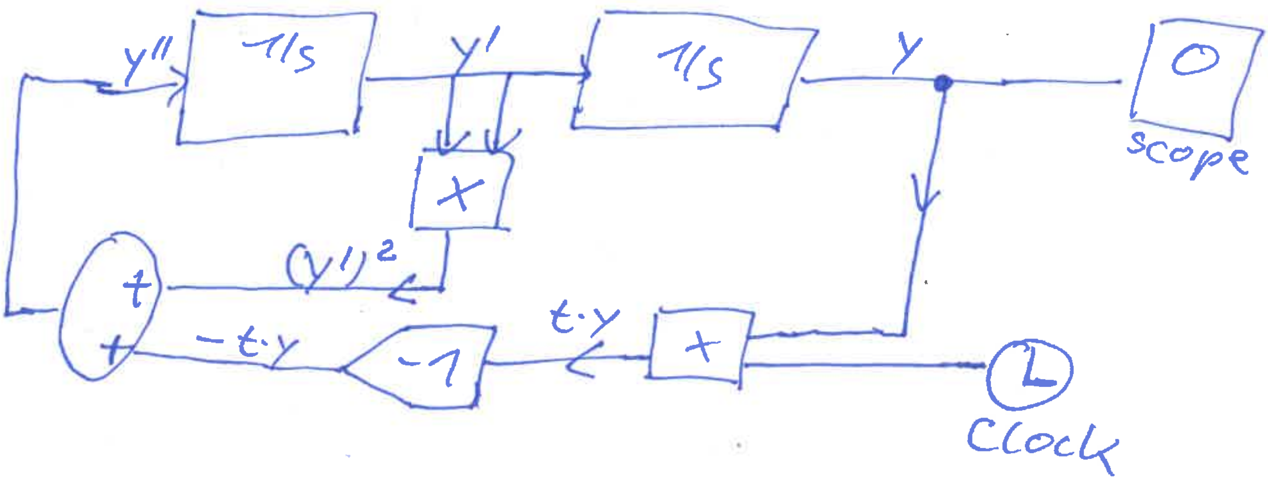
Ex 2) : (1) $y''' + a y'' + b y' + c y = 0$

- Ordnung: 3 $\to$ $\to \boxed{1/s} - \boxed{1/s} - \boxed{1/s} -$
- $y''' = -a y'' - b y' - c y$



(2) $\frac{d^2y}{dt^2} = \left(\frac{dy}{dt}\right)^2 - t y$

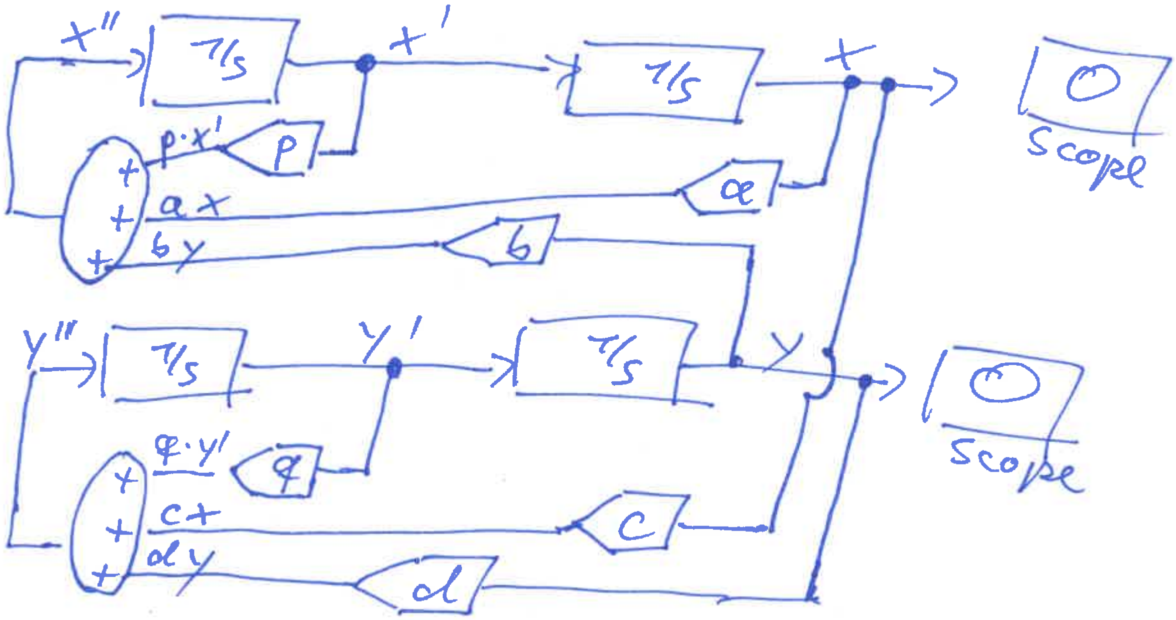
- Ordnung 2 $\to$ 2 Integratoren
- unabhängige Variable t hier explizit



(3) Gekoppeltes System:

$$\left.\begin{aligned} \frac{d^2x(t)}{dt^2} &= p\cdot\frac{dx}{dt} + ax + by \\ \frac{d^2y(t)}{dt^2} &= q\cdot\frac{dy}{dt} + cx + dy \end{aligned}\right\} \text{Bewegung in 2D-Koordinaten}$$

- zwei abhängige Variablen $x(t)$, $y(t)$
- eine unabhängige: t
- Ordnung für $x(t)$: 2
  " " $y(t)$: 2



Ausblick: Vektorisierung

$$\underbrace{\frac{d^2}{dt^2}\begin{bmatrix} x \\ y \end{bmatrix}}_{u} = \begin{pmatrix} p \\ q \end{pmatrix} .* \underbrace{\begin{bmatrix} x' \\ y' \end{bmatrix}}_{u'} + \underbrace{\begin{pmatrix} a & b \\ c & d \end{pmatrix}}_{A} \underbrace{\begin{bmatrix} x \\ y \end{bmatrix}}_{u}$$