$$= 0 - f'(0) + s\left(sF(s) - f(0)\right)$$

$$= s^2 F(s) - f'(0) - s f(0)$$

$$f^{(n)}(t)\cdot u(t) \quad \circ\!\!-\!\!\bullet \quad s^n F(s) - f^{(n-1)}(0) - s f^{(n-2)}(0) - \dots - s^{n-2} f'(0) - s^{n-1} f(0)$$

$$= s^n F(s) - s^{n-1} f(0) - s^{n-2} f'(0) - \dots - s f^{(n-2)}(0) - f^{(n-1)}(0)$$

Anwendungen bei DGL'n:

$$y''(t) + 2\delta y'(t) + \omega_0^2 y(t) = 3t \qquad t \geq 0$$

$\cdot u(t)$

AB: $y(0) = 0$, $y'(0) = 0$

$$y''(t)u(t) + 2\delta y'(t)u(t) + \omega_0^2 y(t)u(t) = 3t\,u(t)$$

$$s^2 Y(s) - y'(0) - s y(0) + 2\delta\left(sY(s) - y(0)\right) + \omega_0^2 Y(s) = 3\cdot\frac{1}{s^2}$$

$$Y(s)\left(s^2 + 2\delta s - \omega_0^2\right) = \frac{3}{s^2}$$

$\delta = 1$, $\omega_0^2 = 3$

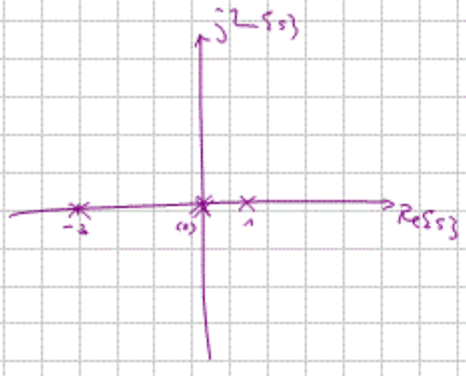
$$Y(s)\left(s^2 + 2s - 3\right) = \frac{3}{s^2} \qquad |:(s^2+2s-1)$$

$$Y(s) = \frac{3}{s^2\left(s^2 + 2s - 3\right)}$$

$s_{1,2} = 0$

$s_{3,4} = -\frac{2}{2} \pm \sqrt{\frac{4}{4} + 3} = -1 \pm \sqrt{4}/2$

$s_3 = 1$, $s_4 = -3$



$$Y(s) = \frac{3}{s^2(s-1)(s+3)}$$

$$= \frac{A}{s} + \frac{B}{s^2} + \frac{C}{s-1} + \frac{D}{s+3}$$

Partialbruchzerlegung

$| \cdot s^2(s-1)(s+3)$

$$3 = A\,s(s-1)(s+3) + B(s-1)(s+3) + C s^2(s+3) + D s^2(s-1)$$