Aufgabe 3.23

3.23. Zerlegen Sie die Übertragungsfunktion G:

$$G(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)} = G_A(s)G_M(s)$$

so in zwei Faktoren, dass G_A die Übertragungsfunktion eines Allpasses und G_M die Übertragungsfunktion eines Mindestphasensystems ist!

Lösung 3.23: aus der Vorlesung

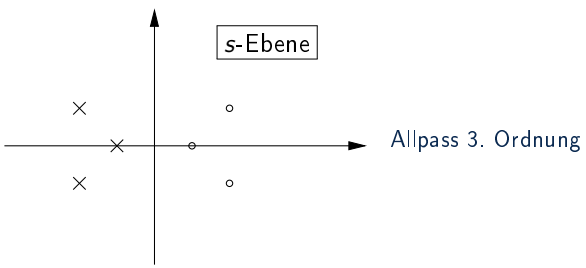
Lösung 3.23: aus der Vorlesung

Allpass und Mindestphasensystem

Definition

Ein zeitkontinuierliches System mit der Eigenschaft $|G(j\omega)| = 1$ ($\omega \in \mathbb{R}$) heißt *Allpass* (AP).

Allgemeine Form: ($f(s)$: Hurwitz-Polynom) $G(s) = \frac{f(-s)}{f(s)}$



PN-Plan: Pole und Nullstellen spiegelbildlich zur imaginären Achse

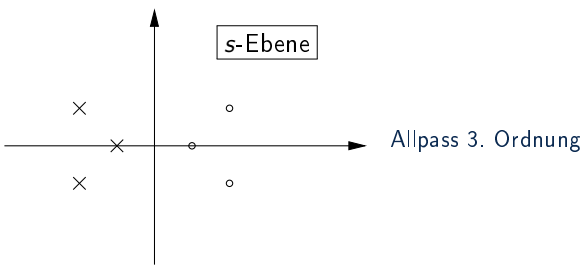
Lösung 3.23: aus der Vorlesung

Allpass und Mindestphasensystem

Definition

Ein zeitkontinuierliches System mit der Eigenschaft $|G(\mathrm{j}\omega)| = 1$ ($\omega \in \mathbb{R}$) heißt *Allpass* (AP).

Allgemeine Form: ($f(s)$: Hurwitz-Polynom) $G(s) = \frac{f(-s)}{f(s)}$

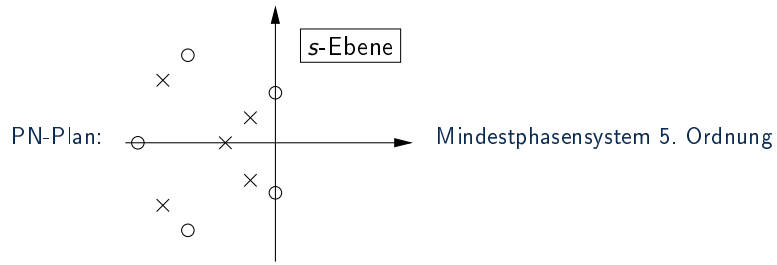


PN-Plan: Pole und Nullstellen spiegelbildlich zur imaginären Achse

Mindestphasensystem

Definition

Ein stabiles System, dessen Übertragungsfunktion G keine Nullstelle s_i mit $\mathrm{Re}(s_i) > 0$ hat, heißt *Mindestphasensystem* (MPS).



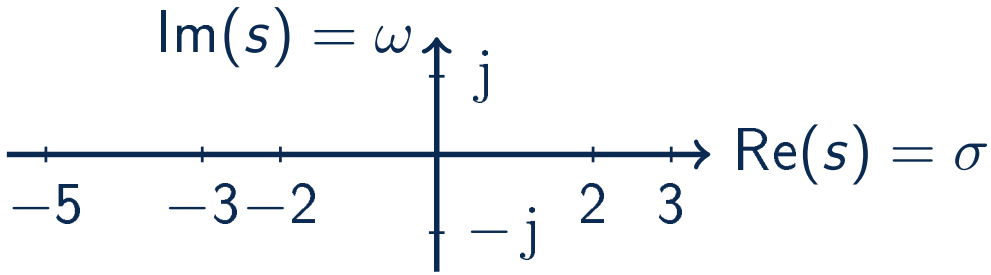
Lösung 3.23

Lösung 3.23

$$G(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)}$$

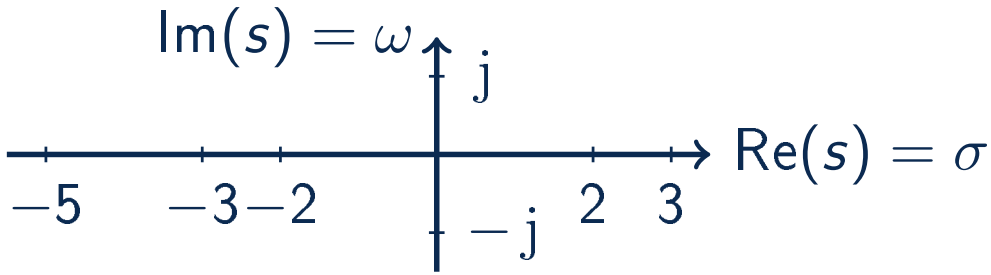
Lösung 3.23

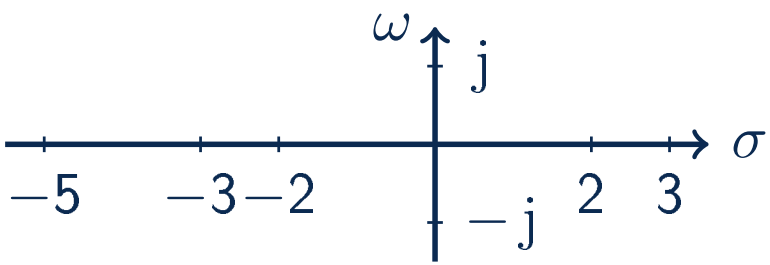
$$G(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)}$$



Lösung 3.23

$$G(s) = G_A(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)}$$

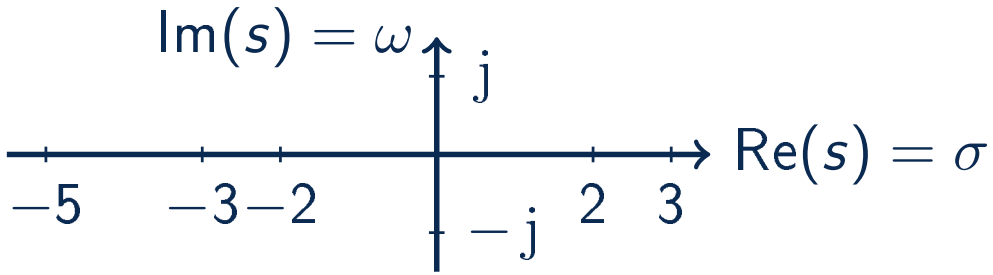


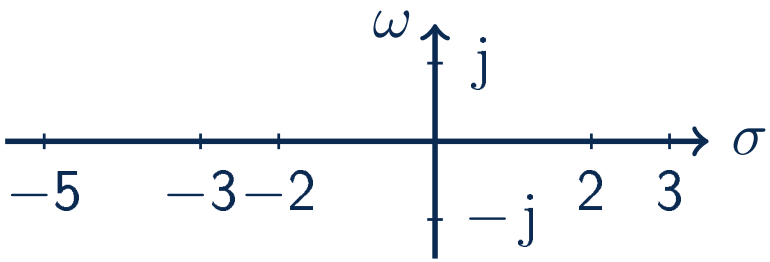


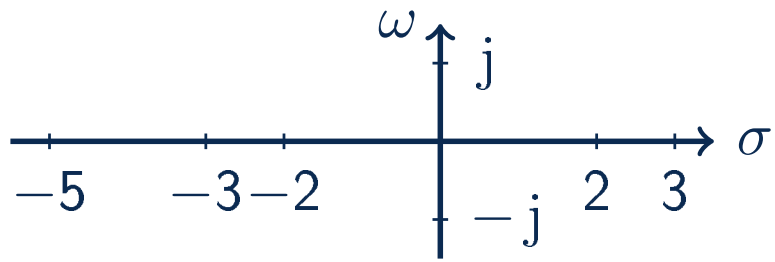
$$G_A(s) = \underbrace{\qquad\qquad}_{\text{Allpass}}$$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)}$$





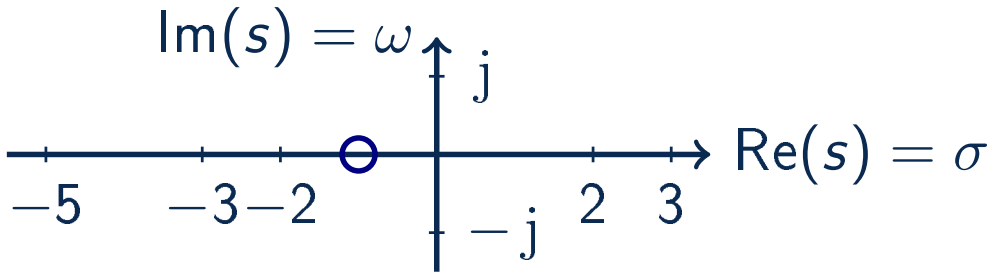


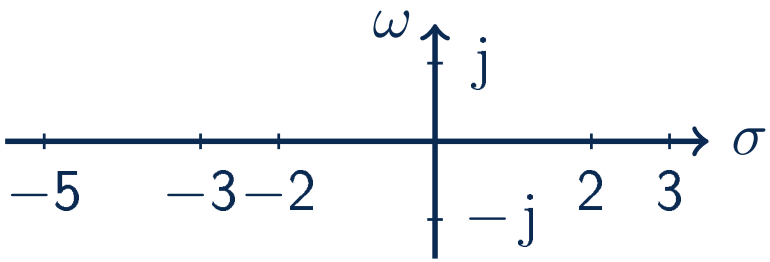
$G_A(s) =$ Allpass

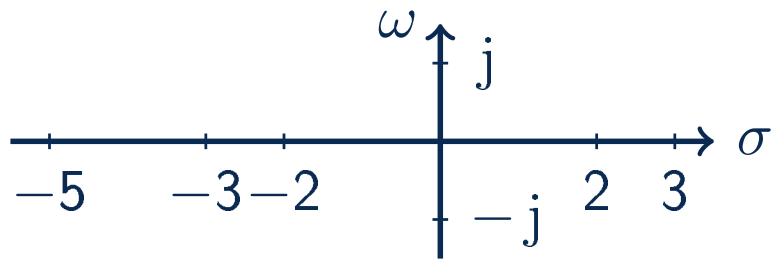
$G_M(s) =$ Mindestphasensystem

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)}{\qquad\qquad\qquad\qquad}$$





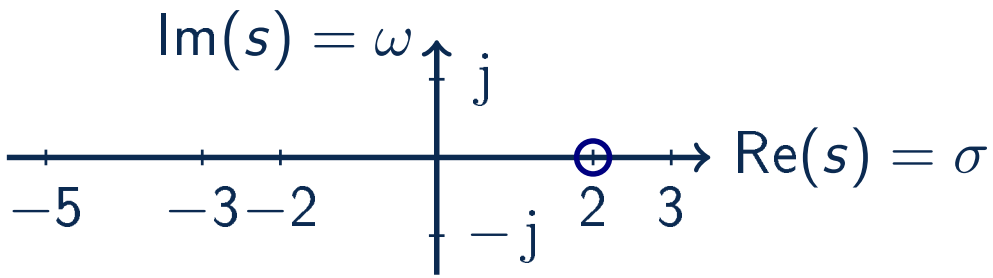


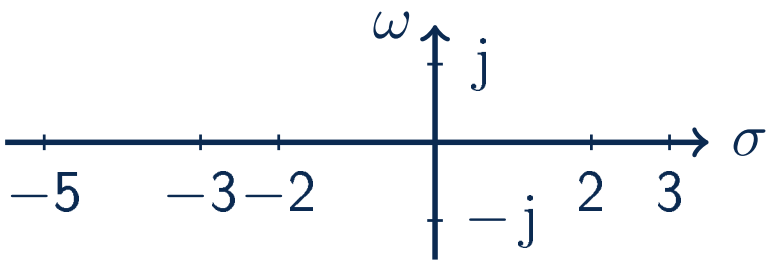
$G_A(s) =$ $\underbrace{\qquad\qquad}_{\text{Allpass}}$

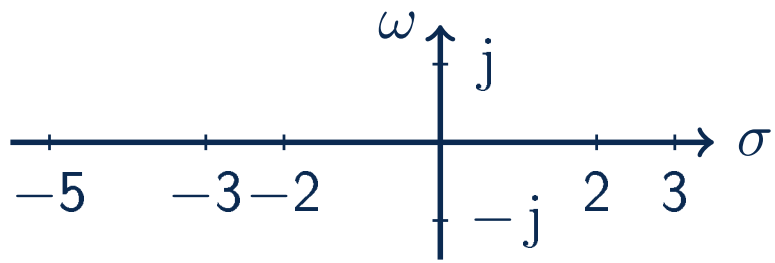
$G_M(s) =$ $\underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s-2)}{}$$





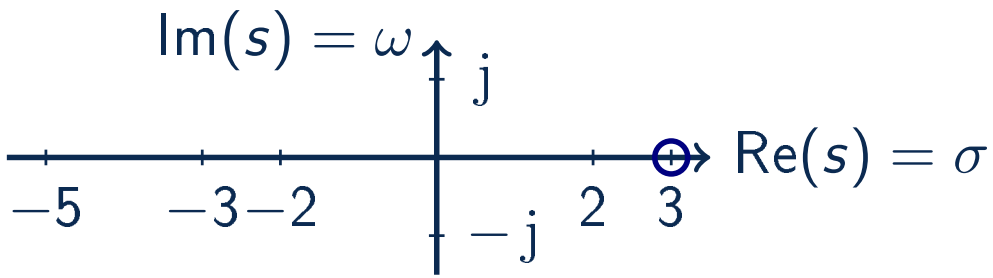


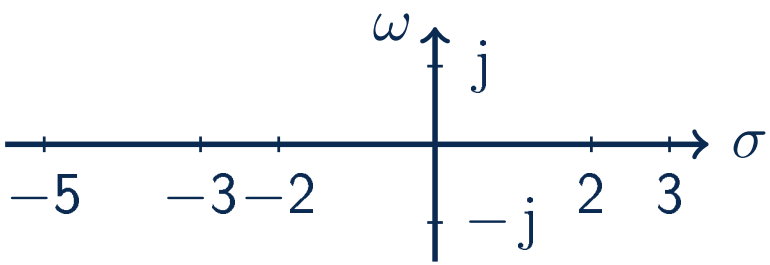
$G_A(s) =$ $\underbrace{\qquad\qquad}_{\text{Allpass}}$

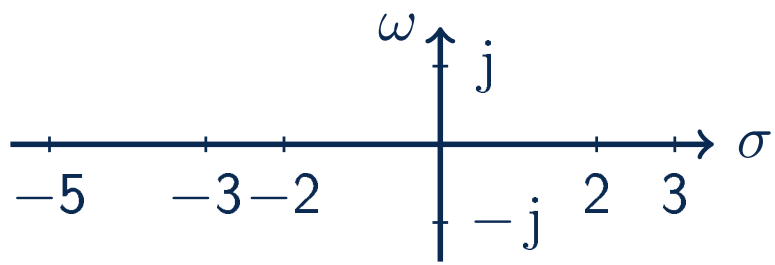
$G_M(s) =$ $\underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s-3)}{}$$





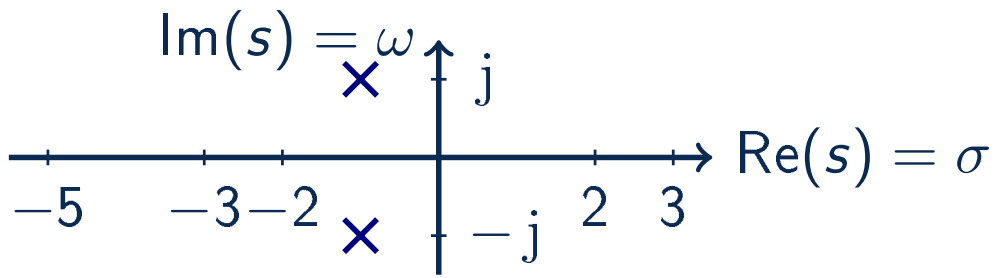


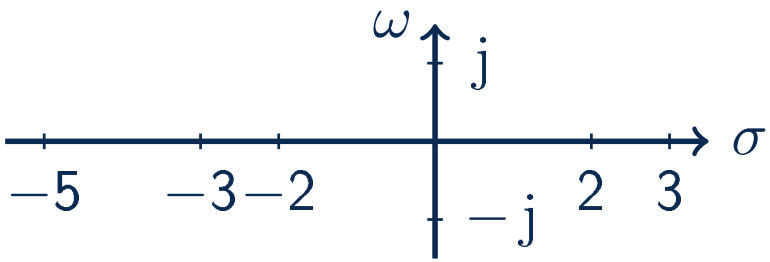
$G_A(s) =$ Allpass

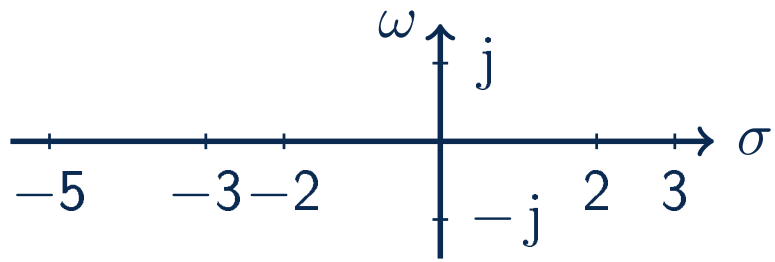
$G_M(s) =$ Mindestphasensystem

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{}{(s^2 + 2s + 2)}$$





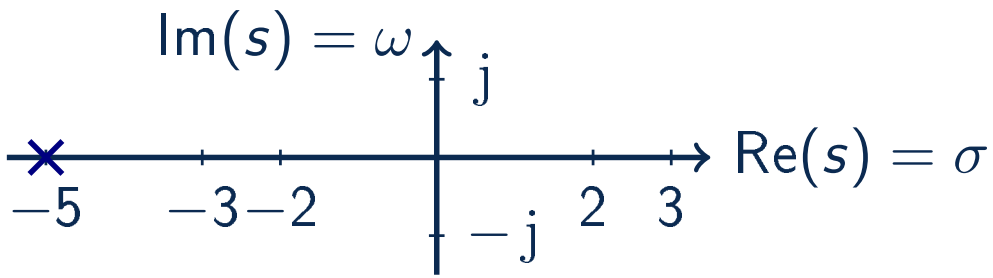


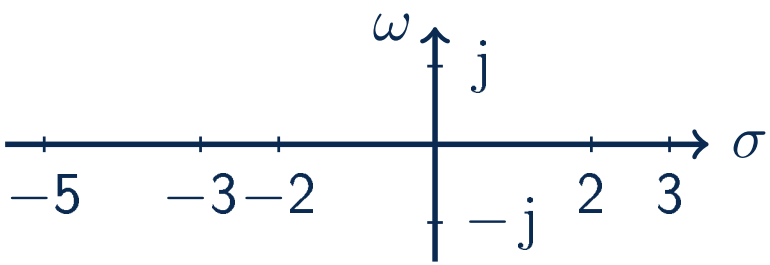
$G_A(s) =$ $\underbrace{\qquad\qquad}_{\text{Allpass}}$

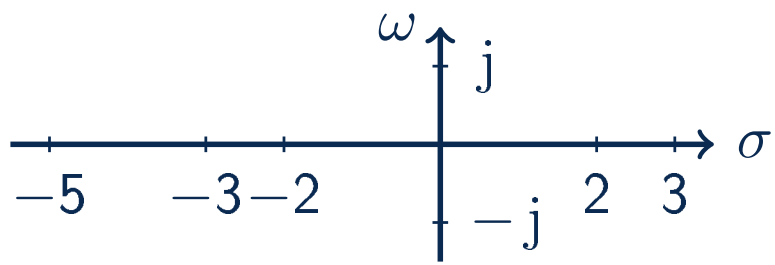
$G_M(s) =$ $\underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{\qquad\qquad}{(s+5)}$$





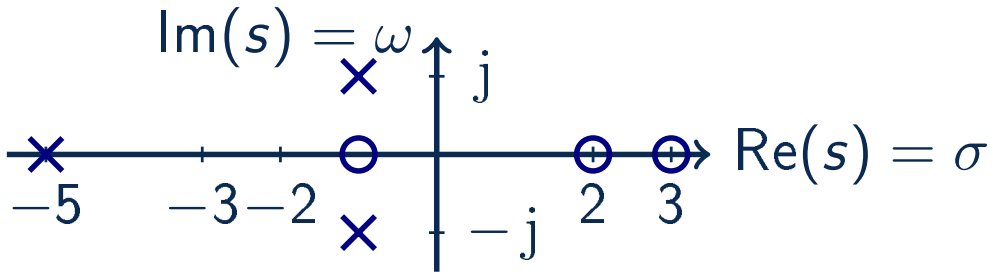


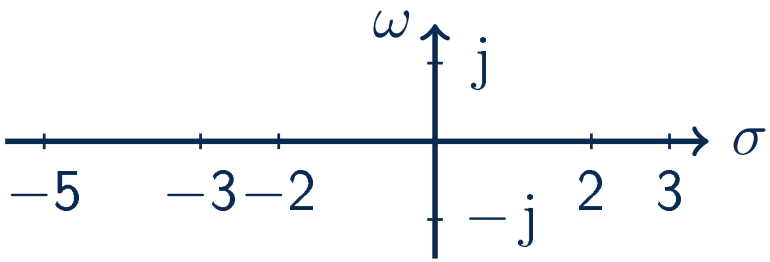
$G_A(s) =$ $\underbrace{\qquad\qquad}_{\text{Allpass}}$

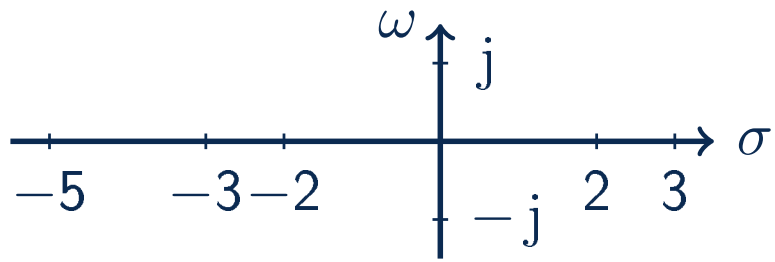
$G_M(s) =$ $\underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)}$$





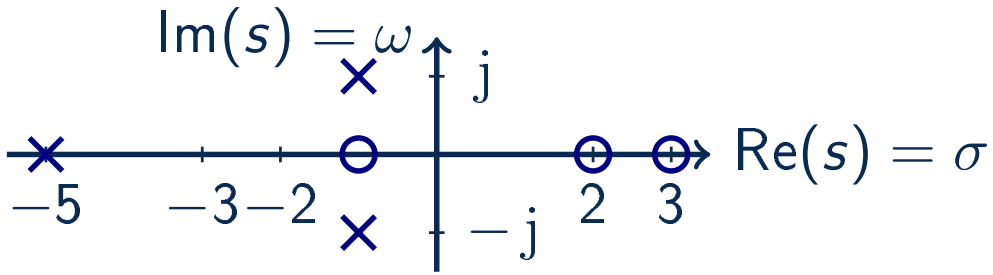


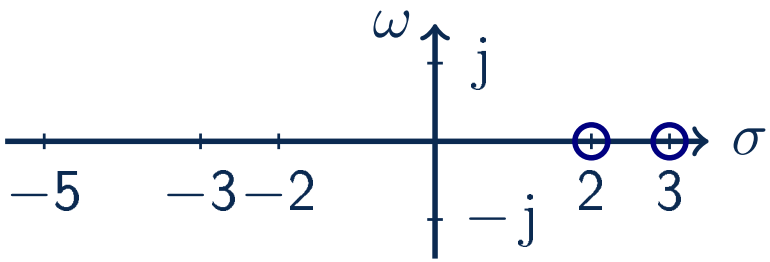
$G_A(s) =$ Allpass

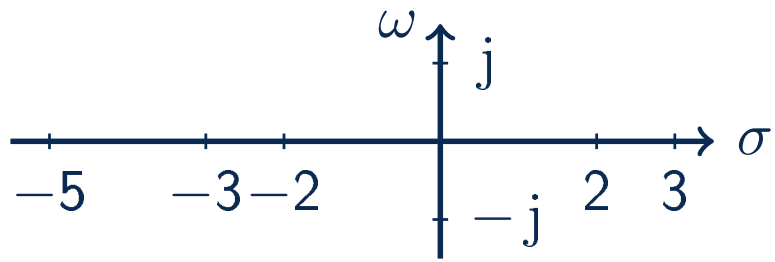
$G_M(s) =$ Mindestphasensystem

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)}$$





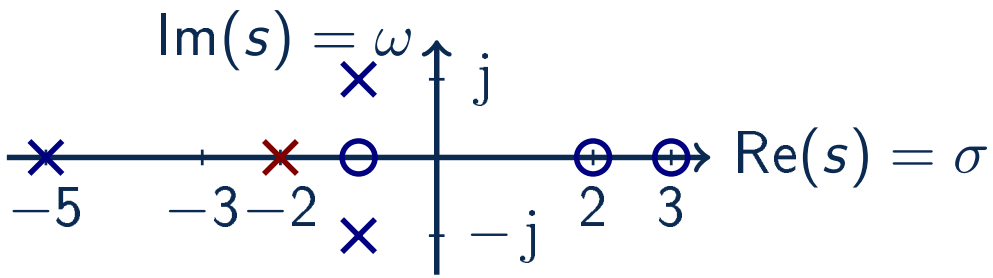


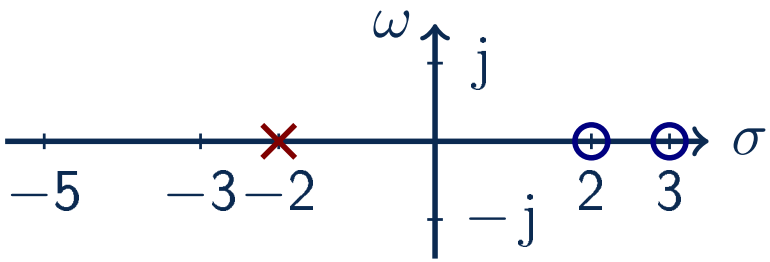
$$G_A(s) = \underbrace{\frac{(s-2)(s-3)}{}}_{\text{Allpass}}$$

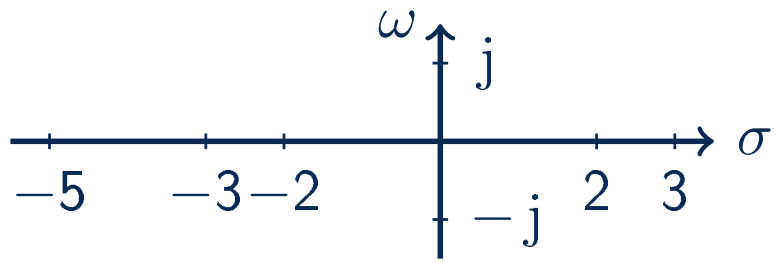
$$G_M(s) = \underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)} \cdot \frac{}{(s+2)}$$





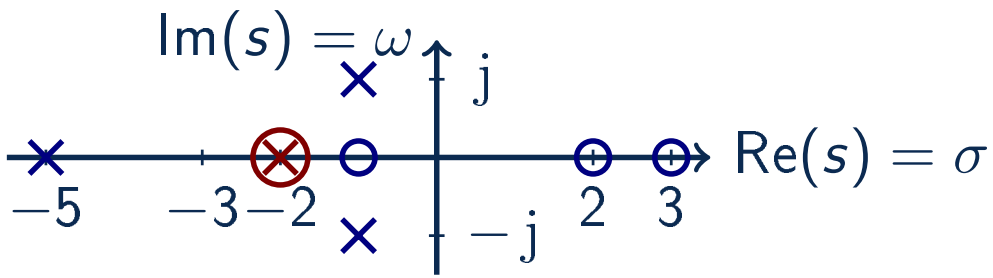


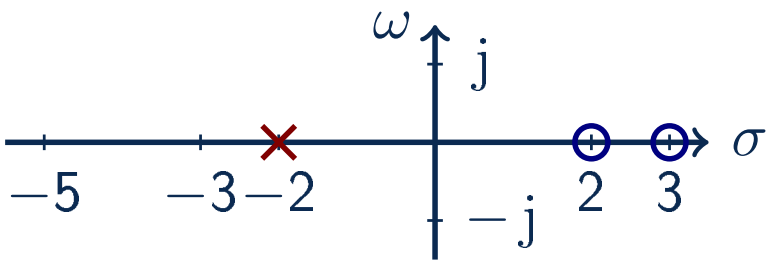
$$G_A(s) = \underbrace{\frac{(s-2)(s-3)}{(s+2)}}_{\text{Allpass}}$$

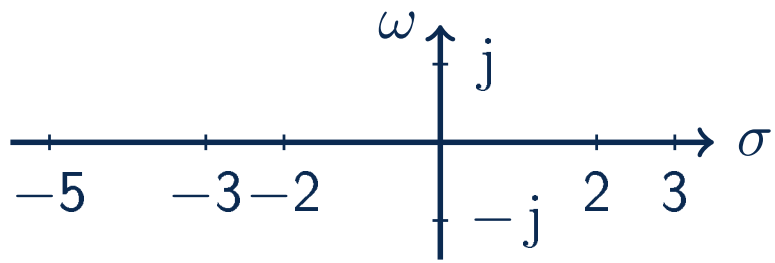
$$G_M(s) = \underbrace{\qquad}_{\text{Mindestphasensystem}}$$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)} \cdot \frac{(s+2)}{(s+2)}$$





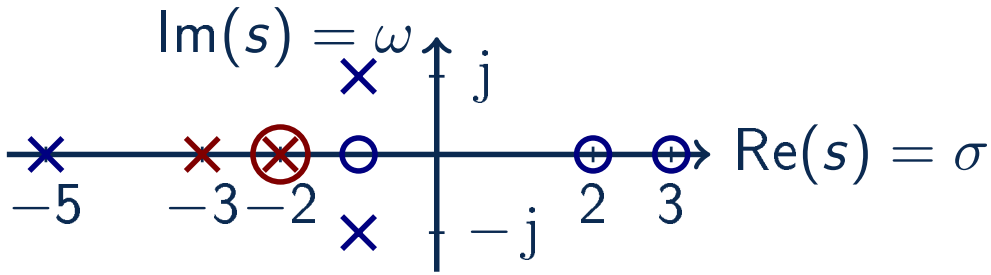


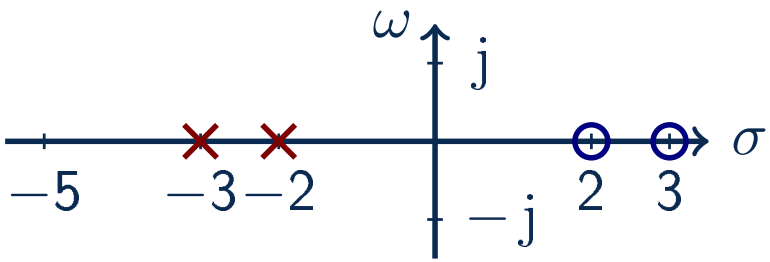
$$G_A(s) = \underbrace{\frac{(s-2)(s-3)}{(s+2)}}_{\text{Allpass}}$$

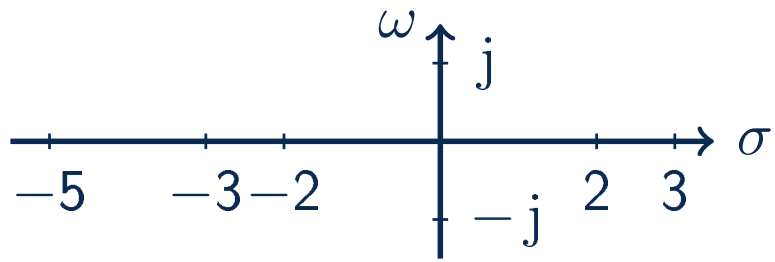
$$G_M(s) = \underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)} \cdot \frac{(s+2)}{(s+2)(s+3)}$$





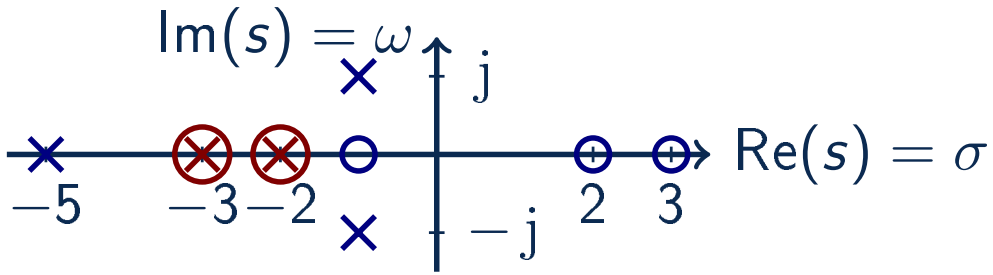


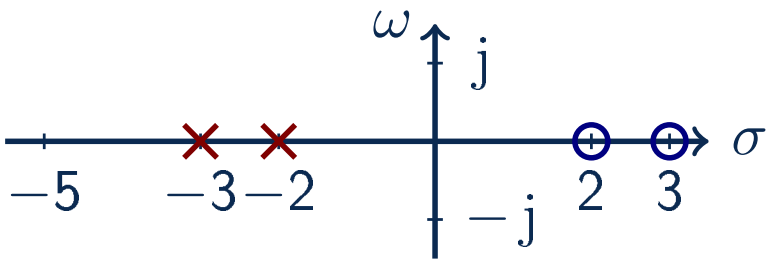
$$G_A(s) = \underbrace{\frac{(s-2)(s-3)}{(s+2)(s+3)}}_{\text{Allpass}}$$

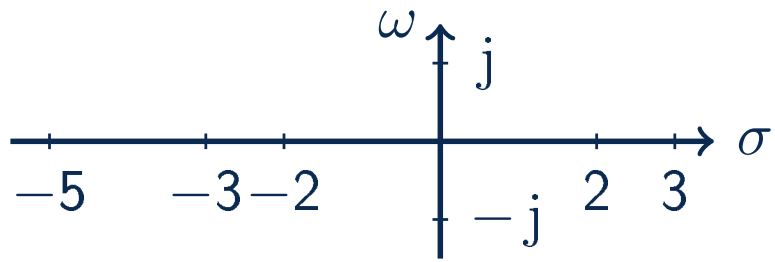
$$G_M(s) = \underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)} \cdot \frac{(s+2)(s+3)}{(s+2)(s+3)}$$





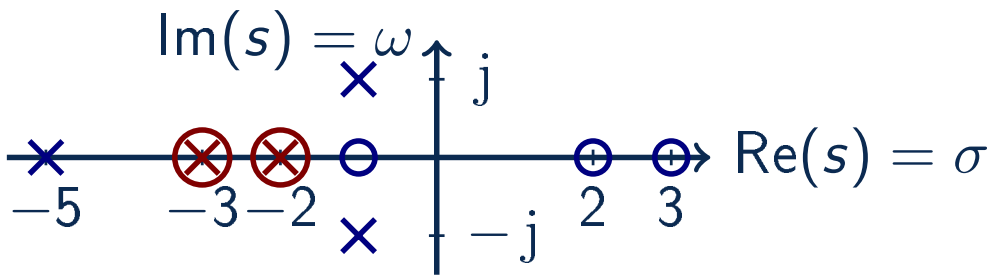


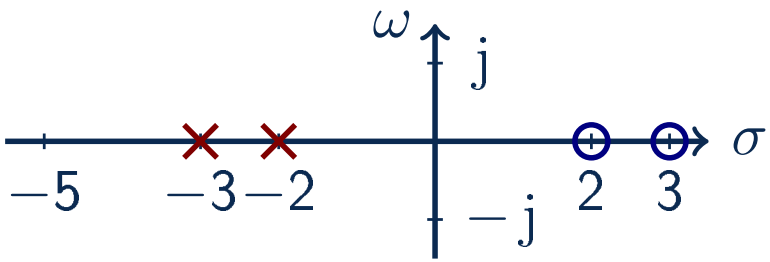
$$G_A(s) = \underbrace{\frac{(s-2)(s-3)}{(s+2)(s+3)}}_{\text{Allpass}}$$

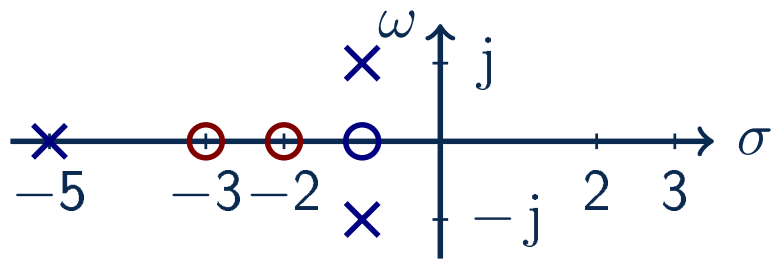
$$G_M(s) = \underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)} \cdot \frac{(s+2)(s+3)}{(s+2)(s+3)}$$





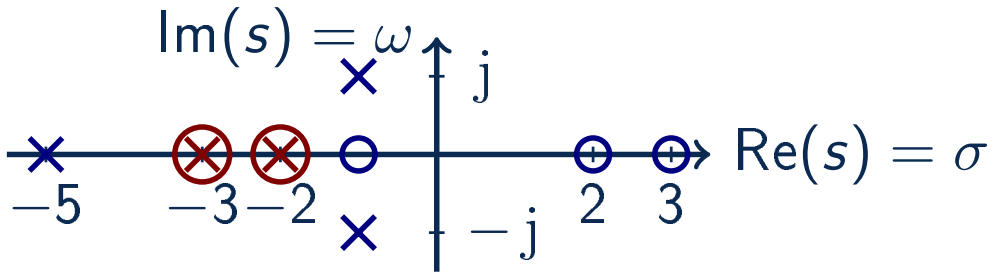


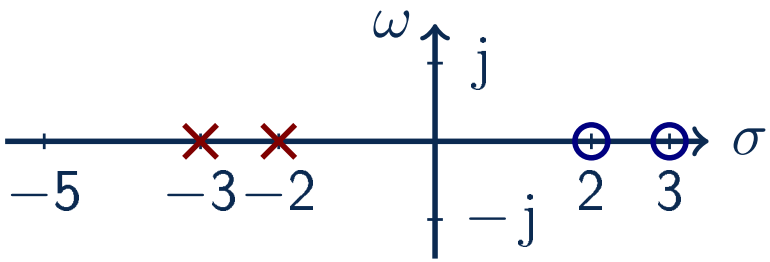
$$G_A(s) = \underbrace{\frac{(s-2)(s-3)}{(s+2)(s+3)}}_{\text{Allpass}}$$

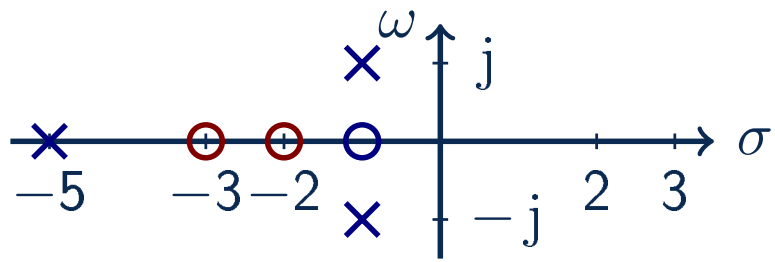
$$G_M(s) = \underbrace{\qquad\qquad}_{\text{Mindestphasensystem}}$$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)} \cdot \frac{(s+2)(s+3)}{(s+2)(s+3)}$$





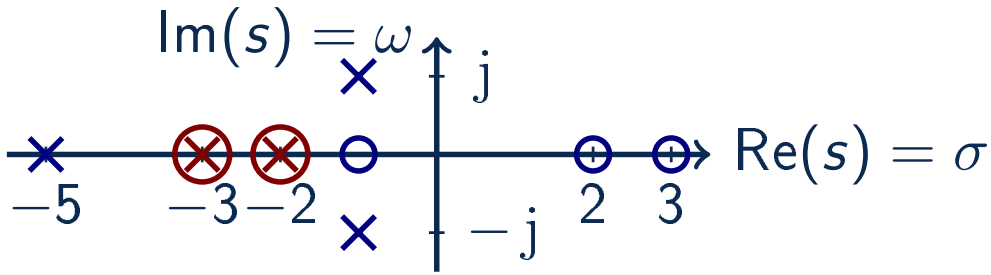


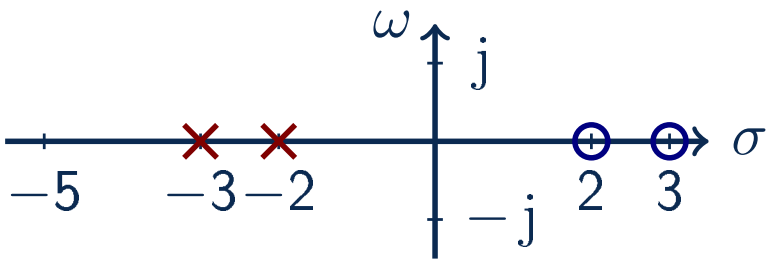
$$G_A(s) = \underbrace{\frac{(s-2)(s-3)}{(s+2)(s+3)}}_{\text{Allpass}}$$

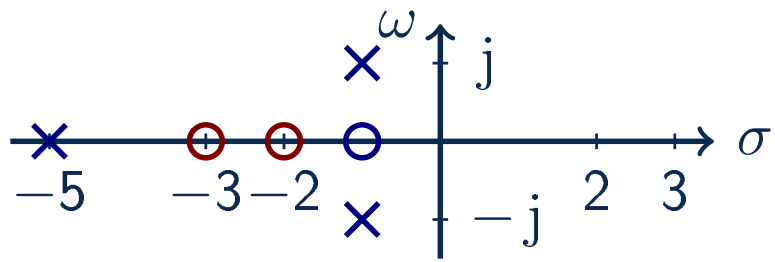
$$G_M(s) = \underbrace{\frac{(s+1)(s+2)(s+3)}{\qquad\qquad}}_{\text{Mindestphasensystem}}$$

Lösung 3.23

$$G(s) = G_A(s) \cdot G_M(s) = \frac{(s+1)(s-2)(s-3)}{(s^2+2s+2)(s+5)} \cdot \frac{(s+2)(s+3)}{(s+2)(s+3)}$$







$$G_A(s) = \underbrace{\frac{(s-2)(s-3)}{(s+2)(s+3)}}_{\text{Allpass}}$$

$$G_M(s) = \underbrace{\frac{(s+1)(s+2)(s+3)}{(s^2+2s+2)(s+5)}}_{\text{Mindestphasensystem}}$$