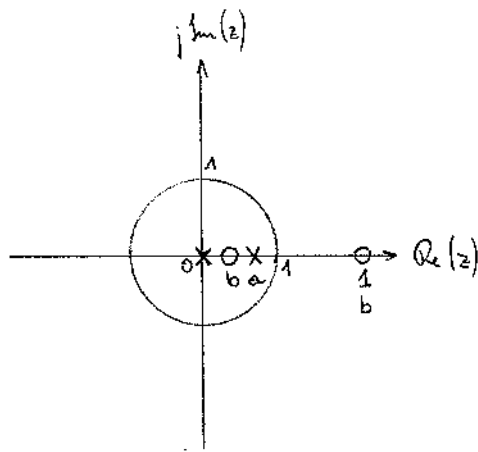


(a)

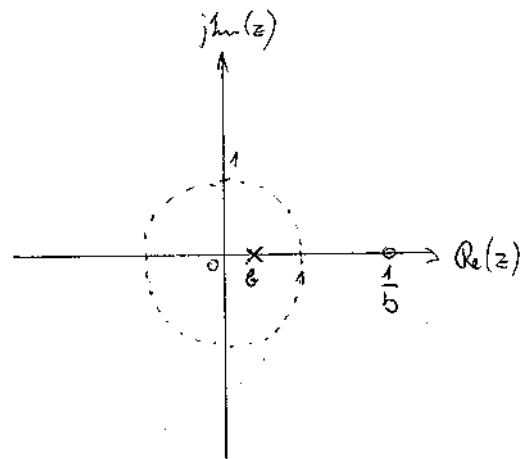
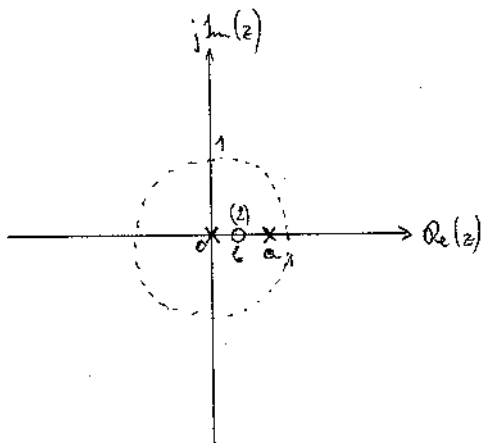


(b) $H(z) = \frac{(z-b)(z-\frac{1}{b})}{z(z-a)} \cdot k$ $z=1 \Rightarrow H(z)=1: \frac{(1-b)(1-\frac{1}{b})}{1-a} \cdot k = 1 \Rightarrow k = \frac{1-a}{(1-b)(1-\frac{1}{b})}$

(c)(d) Minimalrealteilsystem: alle Pole, Nullstellen innerhalb d. Einheitskreises (z)

Allpasssystem: Betrag d. Übertragungsfunktion frequenzunabhängig

$$H(z) = H_m(z) \cdot H_a(z) = \underbrace{k \cdot \frac{(z-b)^2}{z(z-a)}}_{H_m(z)} \cdot \underbrace{\frac{z-\frac{1}{b}}{z-b}}_{H_a(z)}$$



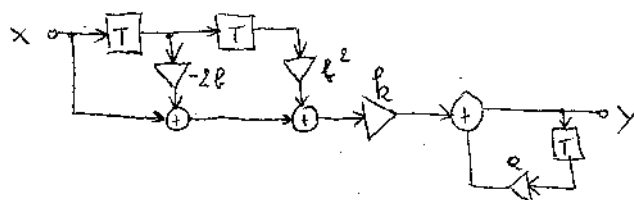
(e) selbstadjungiert

$$(f) \quad H_m(z) = \frac{Y(z)}{X(z)} = b \cdot \frac{(z-b)^2}{z(z-a)} = b \cdot \frac{1-2bz^{-1}+b^2z^{-2}}{1-az^{-1}}$$

$$Y(z) \cdot (1-az^{-1}) = X(z) \cdot b \cdot (1-2bz^{-1}+b^2z^{-2})$$

$$y[n] - ay[n-1] = b \cdot (x[n] - 2bx[n-1] + b^2x[n-2])$$

$$y[n] = ay[n-1] + b(x[n] - 2bx[n-1] + b^2x[n-2])$$



$$H_e(z) = \frac{Y(z)}{X(z)} = \frac{z - \frac{1}{b}}{z - b} = \frac{1 - \frac{1}{b}z^{-1}}{1 - bz^{-1}}$$

$$Y(z) (1 - bz^{-1}) = X(z) (1 - \frac{1}{b}z^{-1})$$

$$y[n] = by[n-1] + x[n] - \frac{1}{b}x[n-1]$$

