Root locus, Bode- and Nyquist plots, relative stability

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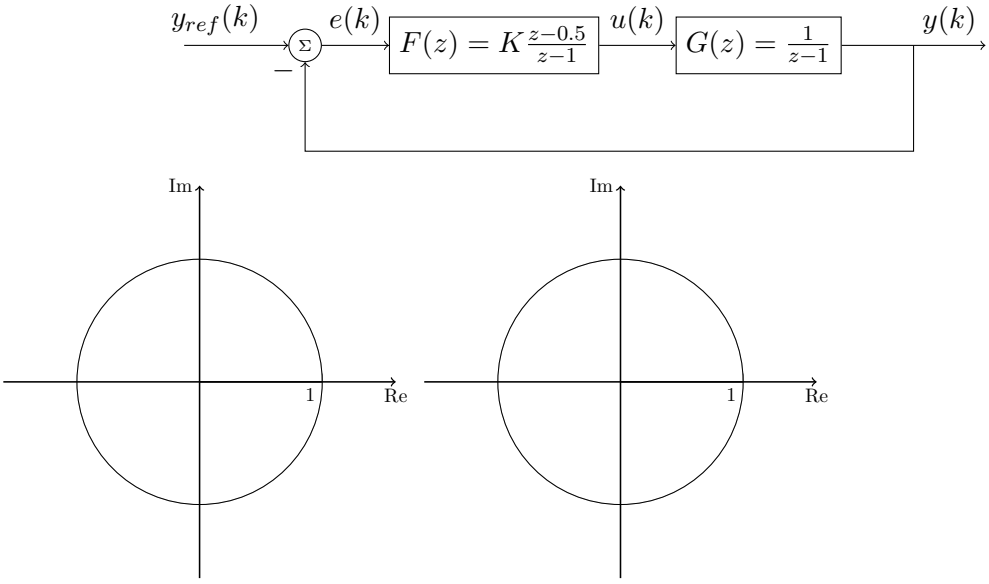
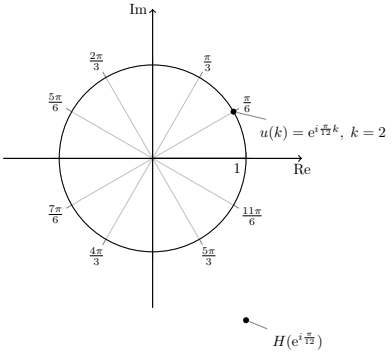
Draw a root locus for PI-control of the reservoir



Frequency response primer: The product of two complex numbers

- At time $k = 2$, the discrete-time complex exponential signal $u(k) = \mathrm{e}^{i\frac{\pi}{12}k}$ has the value $u(2) = \mathrm{e}^{i\frac{\pi}{6}}$.
- A pulse-transfer function $H(z)$ is a mapping from the complex plane to the complex plane, that is $H : \mathbb{C} \to \mathbb{C}$. Consider a specific pulse-transfer function $H(z)$ that when evaluated at $z = \mathrm{e}^{i\frac{\pi}{12}}$ has the value $H(\mathrm{e}^{i\frac{\pi}{12}}) = 2\mathrm{e}^{-i\frac{\pi}{3}}$.

Determine the magnitude, the argument and the imaginary part of the product $H(\mathrm{e}^{i\frac{\pi}{12}})u(2)$. Then mark the first few values of the sequence $H(\mathrm{e}^{i\frac{\pi}{12}})u(k)$.



Bode plot and Nyquist plots

Sketch the Nyquist plot corresponding to the Bode plot! Then mark the phase margin and amplitude margins!