

Problem 3-1:

- Consider the system described by the difference equation:

$$y[k + 2] - 1.5y[k + 1] + 0.5y[k] = u[k + 1]$$

- When $u[k]$ is a step at $k = 0$ and when $y[0] = 0.5$ and $y[-1] = 1$.
- a) Use the z-transform to determine the pulse-transfer function and the poles and zeros of the system (Done in HW02: 2-3).
- b) Determine the output sequence of the difference equation
- c) Find the relationship between its poles/zeros and the kernel (or basis) functions of the output sequence.

Problem 3-2:

- Consider the system:

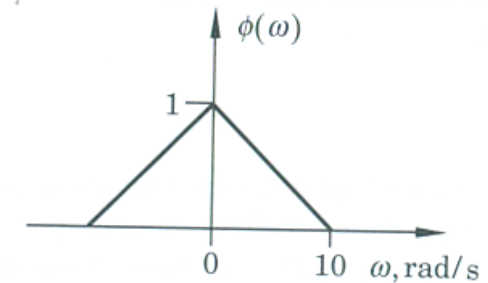
$$\frac{z + b}{(1 + b)(z^2 - 1.1z + a)}$$

- The pole location corresponds to a continuous-time system with damping $\zeta = 0.7$.
- Simulate the system and determine the overshoot for different values of a and b :
 $a \in [0.3, 0.5]$, $b \in [-0.75, 0.75]$

Homework 3: z Transform & Sampling

■ Problem 3-3:

- Assume that the magnitude of the spectrum of a signal is:
- Sketch the magnitude of the spectrum when the signal has been sampled with:
(a) $h = 2\pi/10$ (s); (b) $h = 2\pi/20$ (s); (c) $h = 2\pi/50$ (s).



- You need to identify as many important frequency locations as possible and describe the reason of determining the locations.

■ Problem 3-4:

- Watch the following plenary speech (by either video, slide, or paper):
 - Signal Processing via Sampled-Data Control - A Challenge to Go Beyond Shannon
 - By Prof. Yutaka Yamamoto (Kyoto University, Japan)
 - <http://www.ieeecss-oll.org/lecture/signal-processing-sampled-data-control-challenge-go-beyond-shannon>
 - <http://archive.dimacs.rutgers.edu/Workshops/ControlTheory/Slides/Yamamoto.pdf>
 - <https://ieeexplore.ieee.org/document/6072311>
- Please describe the key information of the speech and summarize the idea delivered in the speech.