Homework 3: z Transform & Sampling

- 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.

b) Determine the output sequence of the difference equation:

- 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:

$$a \in [0.3, 0.5],\ b \in [-0.75, 0.75]$$

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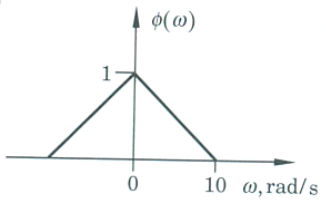
- Problem 3-3:
  - Assume that the magnitude of the spectrum of a signal is:
  - Sketch the magnitude of the spectrum when the signal has been sampled with: *(a) h* = 2π/10 (s); *(b) h* = 2π/20 (s); (c) *h* = 2π/50 (s).



  - 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:
    - 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
  - Please describe the key information of the speech and summarize the idea delivered in the speech.