# Seminar 8: Z-Transform

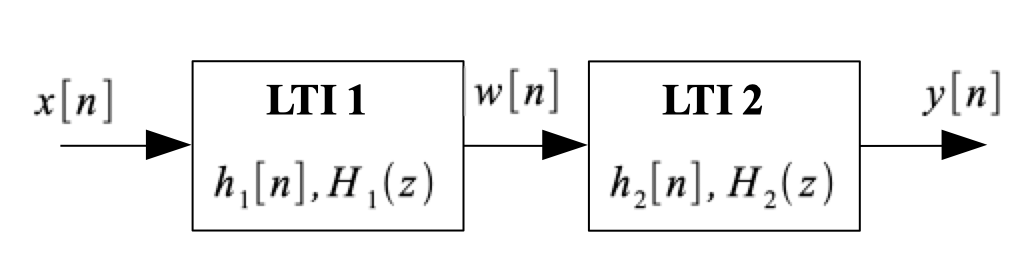
1. An LTI system is described by the difference equation
   1. Determine the system function *H*(*z*) for this system.
   2. Plot the poles and zeros of *H*(*z*) in the *z*-plane.
   3. From *H*(*z*) obtain an expression for , the frequency response of the system.
   4. What is the output if the input is
2. Consider an LTI system whose system function is the product of five terms as follows
   1. Write the difference equation that relates the output of this system to its input.
   2. Plot the poles and zeros of *H*(*z*) in the complex *z-*plane.
   3. If the input is , for what values of will .
3. Suppose that an LTI system is defined by the system function
   1. Write the time-domain description of this system in the form of a difference equation.
   2. Write a formula for the frequency response of the system.
   3. Derive simple formulas for the magnitude response and the phase response versus . These formulas must contain no complex terms and no square roots.
   4. This system can “null” certain input signals. For which input frequencies is the response to equal to zero?
   5. When the input to the system is , determine the output signal in the form . Give numerical values for the constants , , and .
4. An LTI system has the system function

The input to the system is

for . Determine the output of the system corresponding to the above input. Give an equation for that is valid for all *n*.

***Note:*** This is an easy problem if you approach it correctly.

1. Consider a cascade system as shown below



where the system function of the overall system is given as

* 1. Determine the poles and zeros of and plot them in the complex *z*-plane.
  2. Find and such that the overall cascade system has the system function given above, and the output of the first system is given by .
  3. Determine the difference equation that relates to for your answer in part (b).

1. Suppose that a system is defined by
   1. Write the time-domain description of the system in the form of a difference equation.
   2. Write the formula for the frequency response of the system.
   3. Sketch a plot of the magnitude response versus
   4. When the input to the system is determine the output signal
2. An LTI system is described by
   1. Find its system function
   2. Plot the poles and zeros of in the z-plane
   3. Find the frequency response and express it in polar form (magnitude and phase). Remember the “trick”
   4. Sketch for <