Summary for discretization of continuous systems

(ref: <https://en.wikipedia.org/wiki/Discretization> )

1. Problem

to be discretization with zero-order hold as

1. Without noise
   1. Find the solution to the given continuous system (without noise)
   2. Sampling at , here T = 1, for simply notation, then the exact solution is

* 1. Approximate the exact solution for the discrete system
  2. Finalize the discrete system as,

And the other

1. With noise

Since the white noise is a random input, it is appropriate it may not be constant during the sampling time interval.

* 1. the system matrix in (2.4)
  2. the input matrix

Since the covariance of the continuous system is due to Ito’s formula

From the discrete system as

The Covariance of is

Hence there is no analytic way to find but be defined in the covariance sense.

Example: