Note: Information in DT Model

DT Model:

1. The only sampled output $x(nT_s)$ is actually a non-uniformly sampled waveform.
2. The sampled waveform can be modeled as a uniform sampling of the original continuous-time waveform.

Sampling effect:
- Step sampling effect on correctly model sampling.
- AEC: Parem
- Two-to-four conversion is not a frequency effect; the sampling effect of model is anomalous.

Augmented State Space Model

$x_{k+1} = \Phi x_k + W_{k+1}$

Large signal model:
- If $W_k = 0$, $U$ is constant.

Augmented system:

$\tilde{x}[k+1] = \tilde{\Phi} \tilde{x}[k]$

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For stationary signal:

$\tilde{\Phi} = \left[ \begin{array}{cc} \tilde{\Phi}_{11} & \tilde{\Phi}_{12} \\ \tilde{\Phi}_{21} & \tilde{\Phi}_{22} \end{array} \right]$

For unstationary signal:

$\tilde{\Phi} = \left[ \begin{array}{cc} \tilde{\Phi}_{11} & \tilde{\Phi}_{12} \\ \tilde{\Phi}_{21} & \tilde{\Phi}_{22} \end{array} \right]$

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Review: Small Signal Linearization

\[ x_{[h+1]} = \Phi x_{[h]} + \Psi u_{[h]} \quad \text{(large-signal)} \]

\[ x_{[h+1]} = f(x_{[h]}, u_{[h]}, t_i, k_i) \]

If all \( t_i \) remain constant,

\[ x_{[h+1]} = f(x_{[h]}, u_{[h]}) \]

Approximate by 1st order Taylor series expansion:

\[ x_{[h+1]} = x_{[h]} + \frac{df(.)}{dx} x_{[h]} + \frac{df(.)}{du} u_{[h]} \]

\[ \hat{x}_{[h+1]} = \Phi \hat{x}_{[h]} + \Psi \hat{u}_{[h]} \]

What happens when \( t_i \) are not all constant?