Converter Small Signal Model

\[ x_{n+1} = \Phi(x_n) + \Psi(u_n) \]

\[ \hat{x}_{n+1} = \Phi(\hat{x}_n) + \Psi(\hat{u}_n) + \sum_{k} \tilde{d}_k \]

\[ \hat{v}_n = \delta (\hat{x}_n - \Phi(\hat{x}_n)) + \beta \]

\[ \dot{\hat{x}}_p = \Delta \hat{x}_p + A_1 (e^{\Delta \hat{x}_p} - I) B_1 u \]

\[ - \left[ e^{A_1 \Delta \hat{t}_3} \hat{x}_p + A_2 (e^{A_2 \Delta \hat{t}_3} - I) B_2 u \right] \]

\[ \Delta \hat{t}_3 \rightarrow I + A \Delta \hat{t}_3 \]

\[ \hat{x}_p = \left( I - A \Delta \hat{t}_3 \right) \hat{x}_p - \left( I + A_2 \Delta \hat{t}_3 \right) \hat{x}_p \]

\[ + B_1 u \Delta \hat{t}_3 - B_2 u \Delta \hat{t}_3 \]

\[ \hat{x}_p = \left[ (A_1 - A_2) \hat{x}_p + (B_1 - B_2) u \right] \Delta \hat{t}_3 \]
\[ x_{d+1} = e^{A_1(t_{k+1} - t_k)} (x_k + \hat{\Delta} \Delta(t)) B_2 u \]

\[ x_d = e^{A_1 t_k} x_p + A_2 (e^{A_2 t_k} - I) B_2 u \]

\[ \dot{x}_a = e^{A_2 t_k} \dot{x}_p \]

\[ \hat{x}_d = e^{A_2 t_k} [(A_1 - A_2) x_p + (B_1 - B_2) u] \Delta T_s \]

\[ \hat{x}_a = \Gamma \hat{\Delta}[k] \]

\[ \Gamma = e^{A_2 t_k} [(A_1 - A_2) x_p + (B_1 - B_2) u] T_s \]

**ADC Synchronization**

The diagram illustrates the process of sampling and synchronization in an ADC system. The figure shows the sampling points and the intervals between samples, highlighting the synchronization process at specific time points, such as \((n)T_s\), \((n+1)T_s\), and \((n+2)T_s\). The synchronization process is critical for accurately capturing the signal's behavior over time.