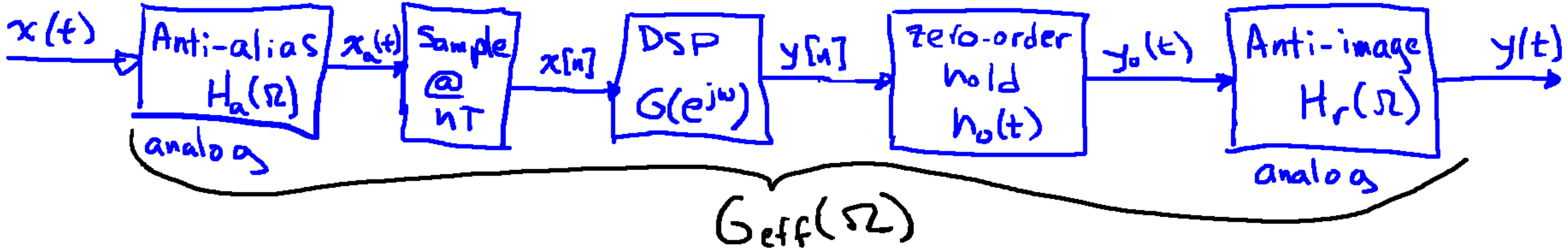
Practical Digital Filtering and Oversampling

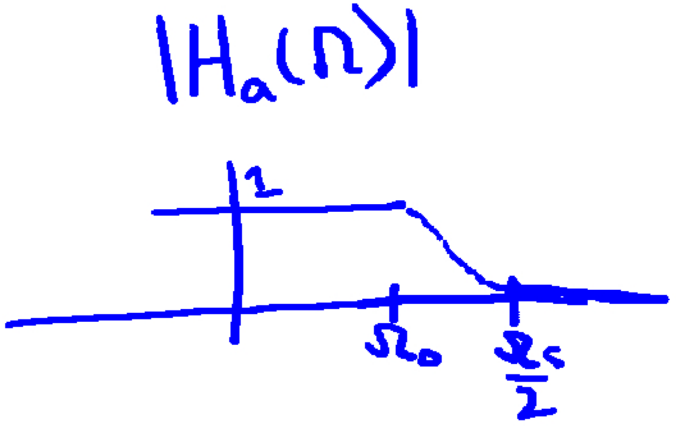


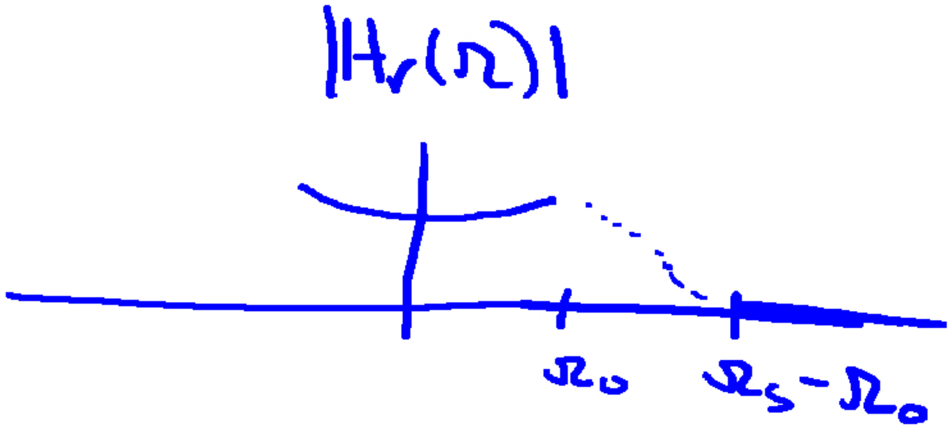
Provided $|H_a(\Omega)| \approx 0 \quad |\Omega| > \frac{\Omega_s}{2}$

$|H_r(\Omega)| \approx 0 \quad |\Omega| > \frac{\Omega_s}{2}$

$$\Rightarrow G_{eff}(\Omega) = \begin{cases} H_a(\Omega) G(e^{j\Omega T}) H_0(\Omega) H_r(\Omega) & |\Omega| < \frac{\Omega_s}{2} \\ 0, & |\Omega| > \Omega_s/2 \end{cases}$$

Building narrow transition band filters $H_a(\Omega)$ and $H_r(\Omega)$ is difficult / expensive

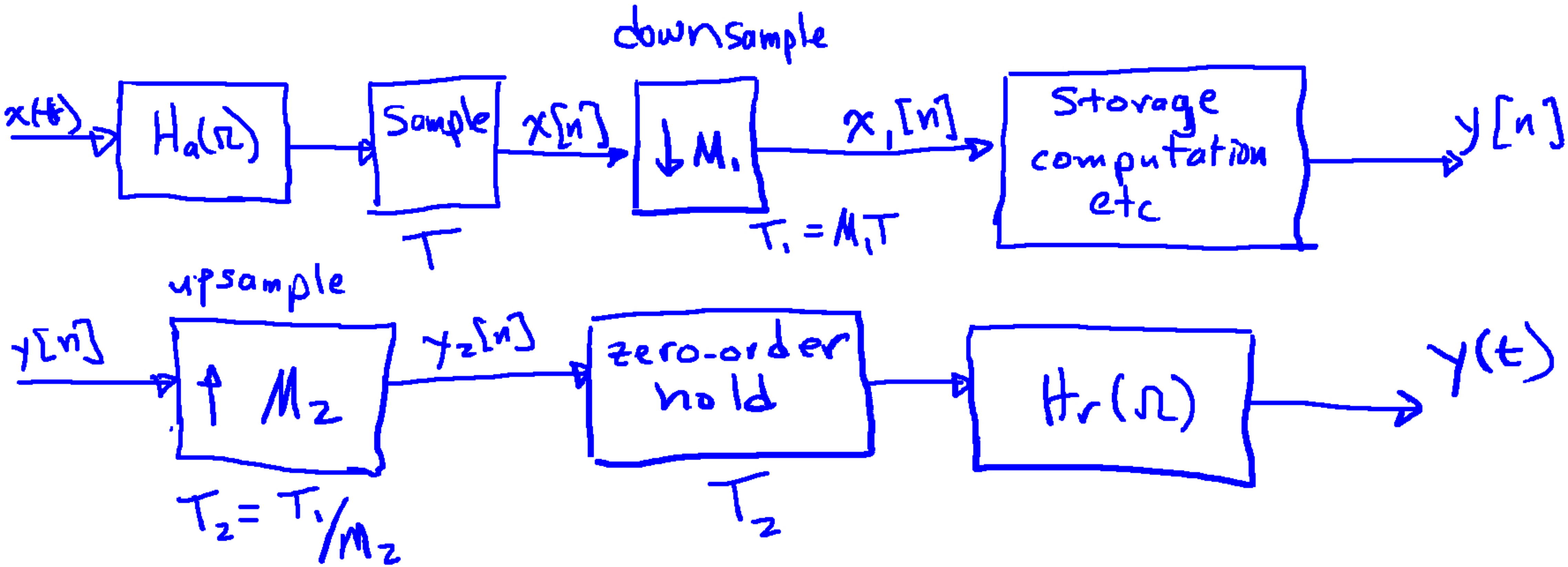




$\Rightarrow$ Want $\frac{\pi}{T} \gg \Omega_0$ Ω_0: highest freq of interest in $x(t)$

$\Rightarrow$ T small: need fast computation, excessive data storage

Change sampling rate – downsampling, upsampling



low cost – analog filters, storage/computation

price – extra computation for ↓M_1 and ↑M_2, faster A/D and D/A