COMSATS Institute of Information Technology

EEE 324 Digital Signal Processing

Lecture 6

Changing the Sampling Rate by a non-integer Factor

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Contents

- Changing the Sampling Rate by a non-integer Factor

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Changing the Sampling Rate by a non-integer Factor

- Decimation and Interpolation can be combined to achieve a sampling rate change of non-integer factor.

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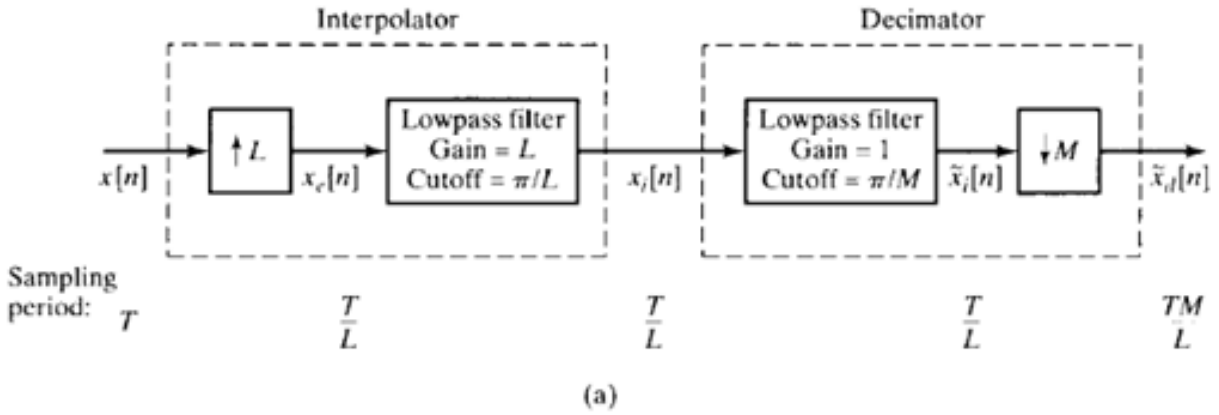
Changing the Sampling Rate by a non-integer Factor



(a)

- $M > L$ (Sampling rate decreases)
- $L > M$ (Sampling rate increases)

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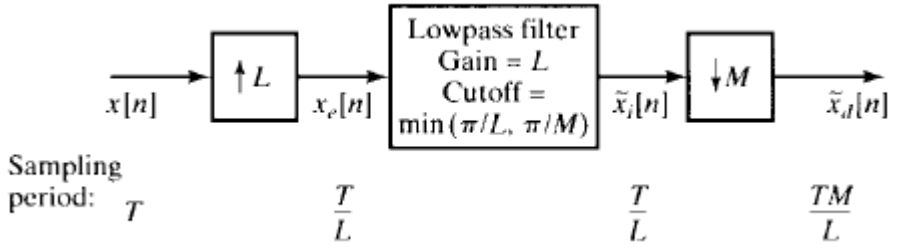
- The interpolation and decimation filters can be combined into one filter.



- The new filter has a gain L and a cut-off frequency $\min\left(\frac{\pi}{L}, \frac{\pi}{M}\right)$
- If $M > L$, then π/M is the dominant cut-off frequency and there is a net reduction in the sampling rate.
  - $x'_d[n]$ will be a low-pass filtered version of the original underlying band-limited signal if we are to avoid aliasing.
- If $L > M$, then π/L is the dominant cut-off frequency and there is a net increase in the sampling rate.
  - There is no need to further limit the bandwidth of the signal below the original Nyquist frequency.

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- Example 4.11
  - $T' = \frac{3}{2}T, \quad M = 3, L = 2$
  - $\Omega_s = 2\Omega_N, \Omega_N = \frac{1}{2}\Omega_s, \omega_N = \pi$

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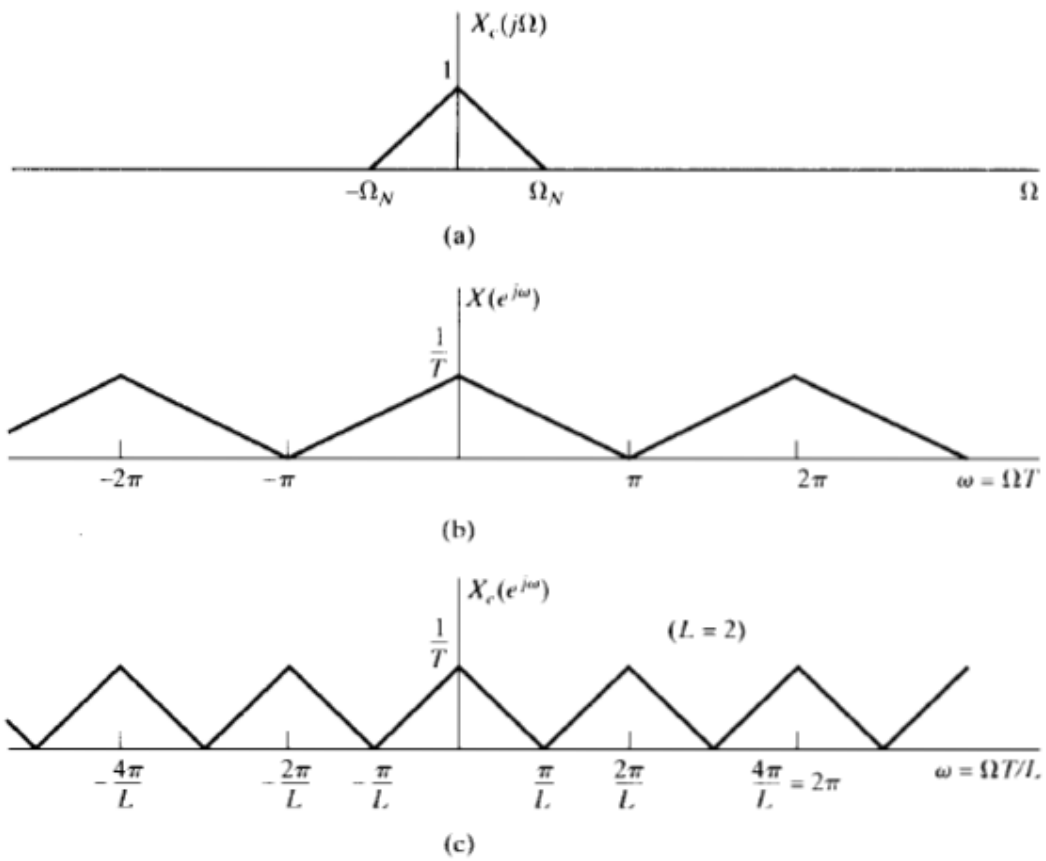

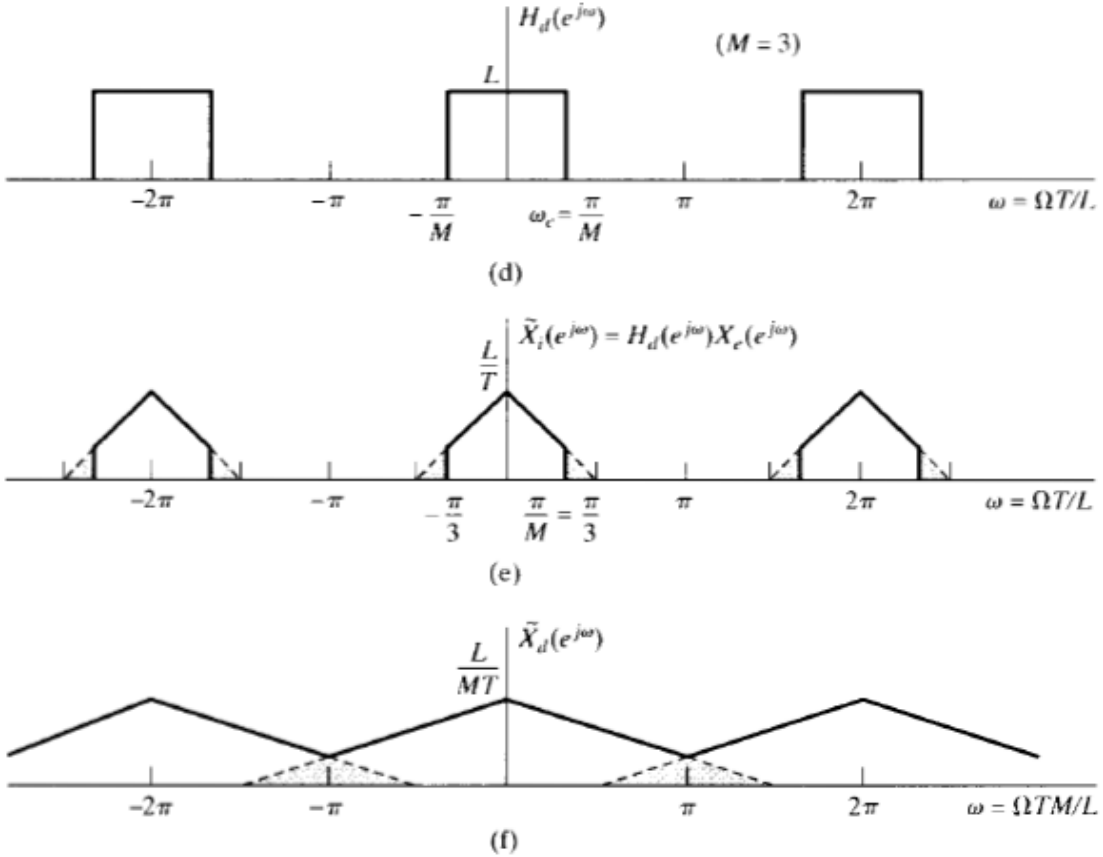

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