Recap

Reconstruction

Topics for this session

Quadrature sampling of band-pass signals

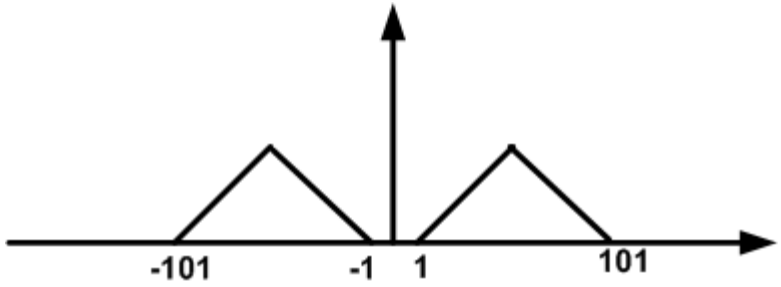
Quadrature Sampling of Band-pass signals

Sampling of Band pass signals – software/digital radio used to receive AM or FM signals

- Output of modulation
- For reconstruction fs ≥ Nyquist rate

DIGITAL COMMUNICATION

Quadrature Sampling of Band-pass signals



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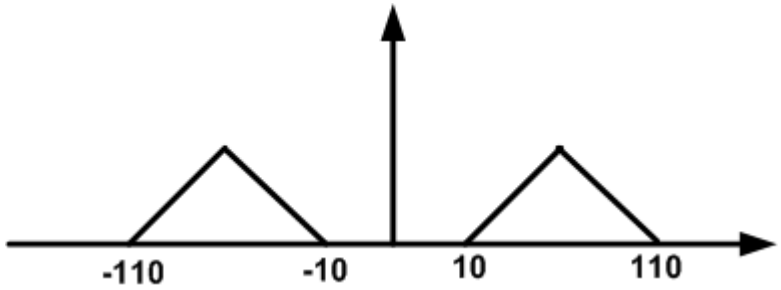

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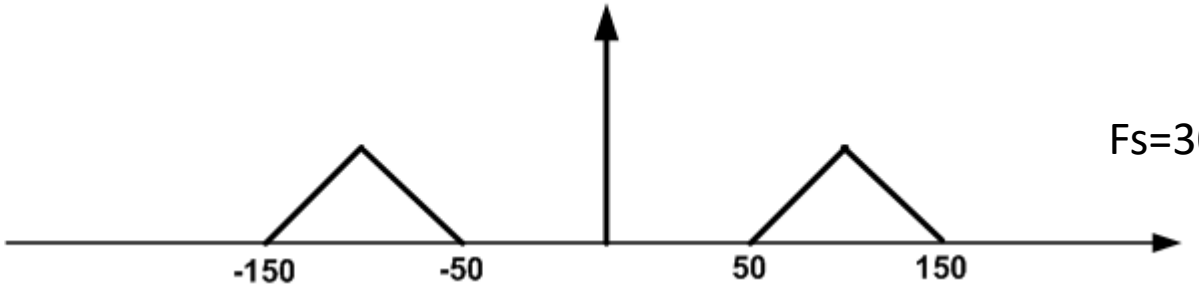

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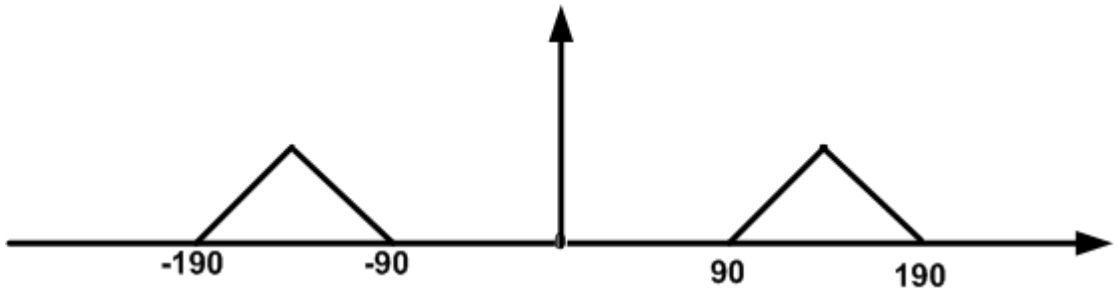
DIGITAL COMMUNICATION

Quadrature Sampling of Band-pass signals



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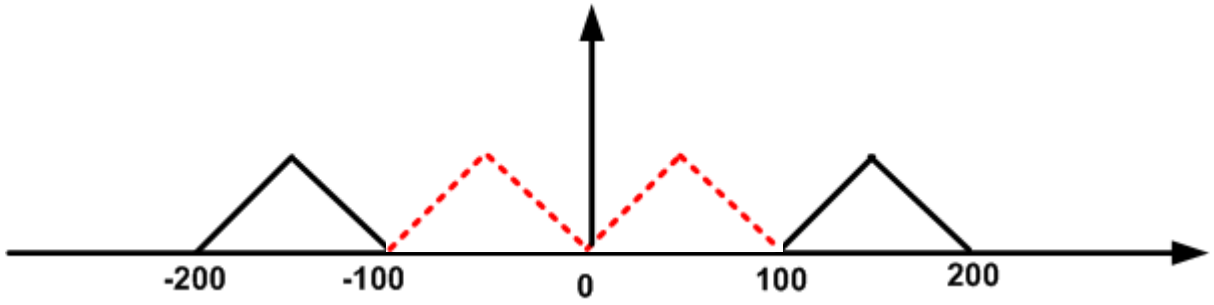

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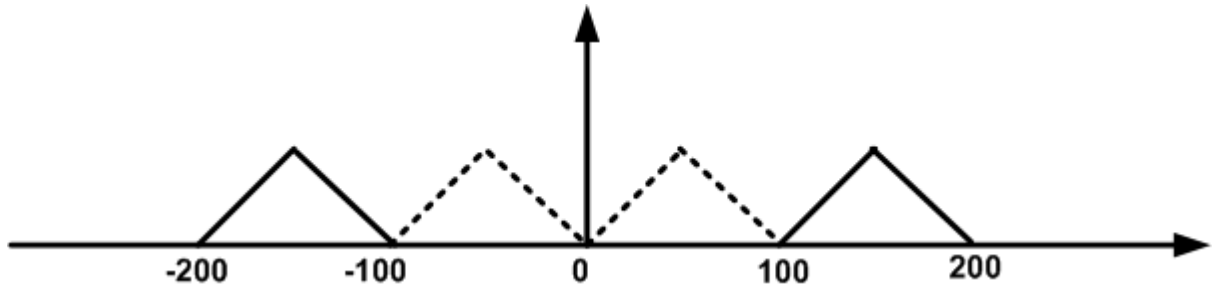
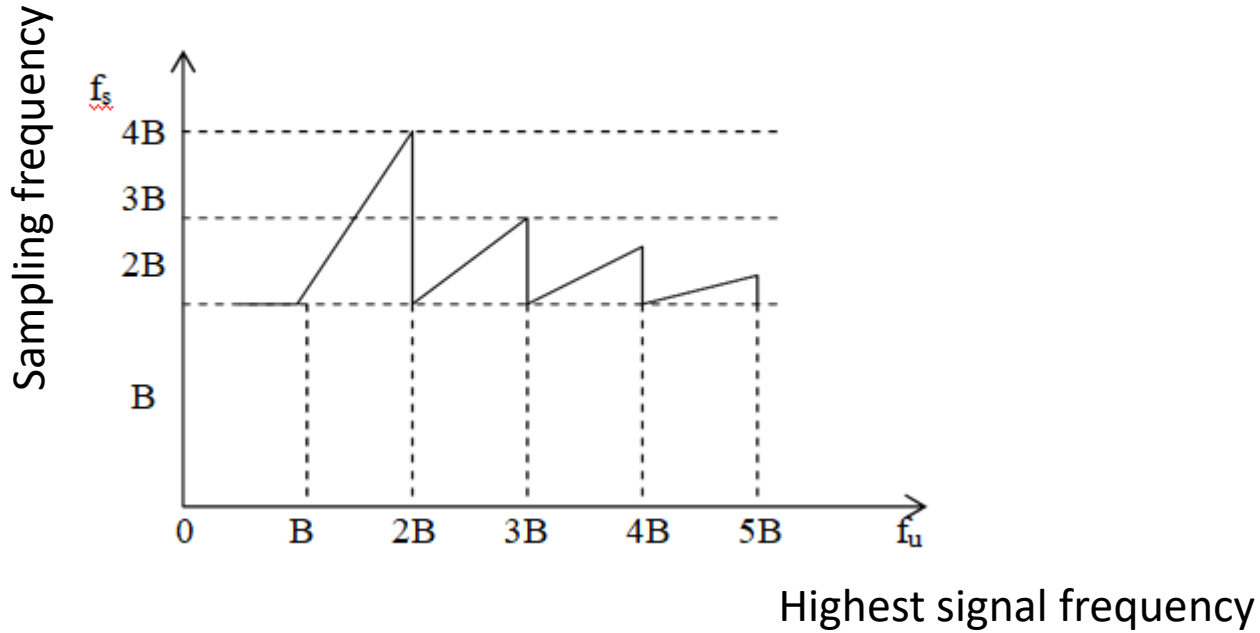


DIGITAL COMMUNICATION

Quadrature Sampling of Band-pass signals



Quadrature Sampling of Band-pass signals

fs varies from 2W to 4W

Canonical representation of Band-pass signal is

$$g(t) = g_I(t)\cos(2\pi f_c t) - g_Q(t)\sin(2\pi f_c t)$$

$g_I(t)$ - In-phase component

$g_Q(t)$ - Quadrature component

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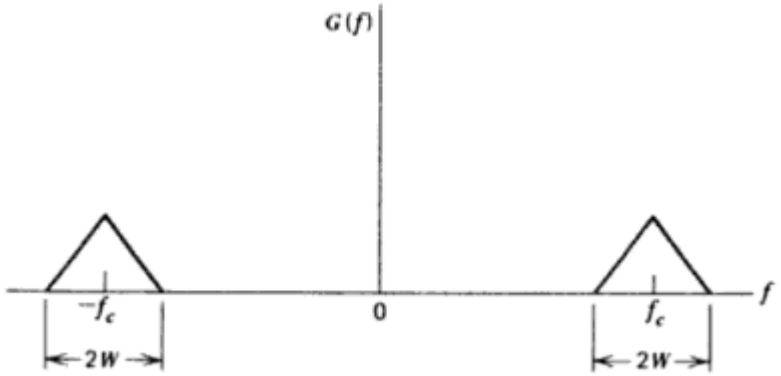
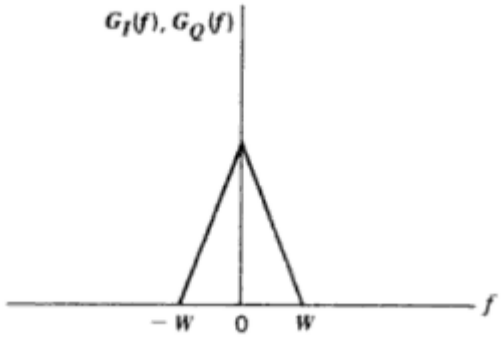
Quadrature Sampling of Band-pass signals





Quadrature Sampling of Band-pass signals

$$g(t).2\cos(2\pi f_c t) = g_I(t)2\cos^2(2\pi f_c t) - g_Q(t)2\cos(2\pi f_c t)\sin(2\pi f_c t)$$

$$= g_I(t)\left[1+\cos(4\pi f_c t)\right] - g_Q(t)\sin(4\pi f_c t)$$

Low pass filter output is $g_I(t)$

In-phase component

Quadrature Sampling of Band-pass signals

$$g(t).2\sin(2\pi f_c t) = g_I(t)2\sin(2\pi f_c t)\cos(2\pi f_c t) - g_Q(t)2\sin^2(2\pi f_c t)$$

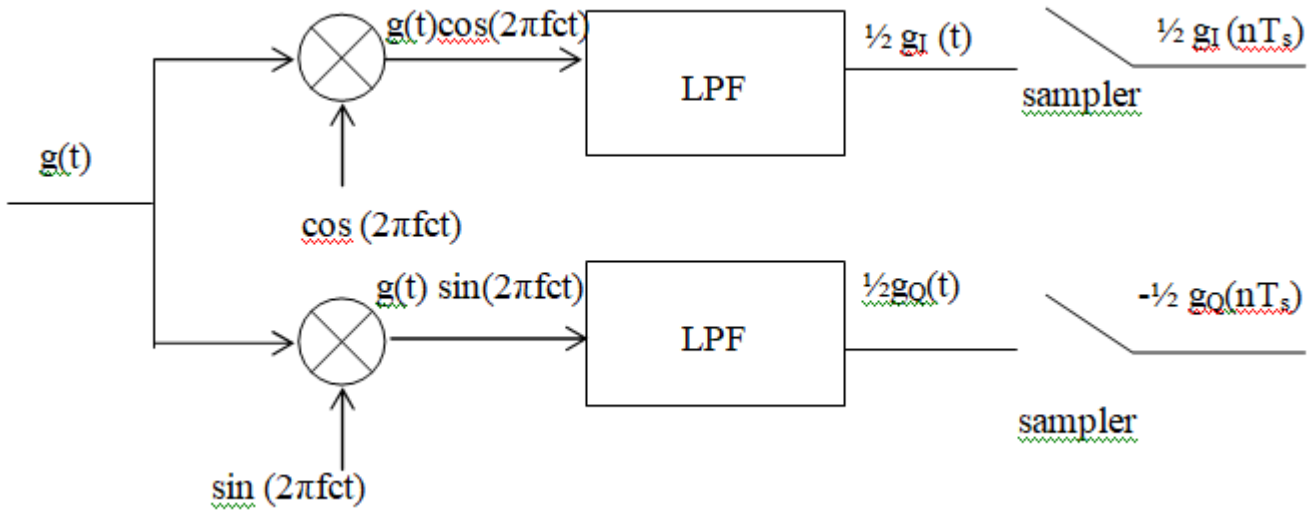
$$= g_I(t)\sin(4\pi f_c t) - g_Q(t)\left[1-\cos(4\pi f_c t)\right]$$

Low pass filter output is $-g_Q(t)$

Quadrature component

DIGITAL COMMUNICATION

Quadrature Sampling of Band-pass signals



Quadrature Sampling of Band-pass signals

Reconstruction process

$$g_I(t).\cos(2\pi f_c t) - g_Q(t)\sin(2\pi f_c t) = g(t)$$