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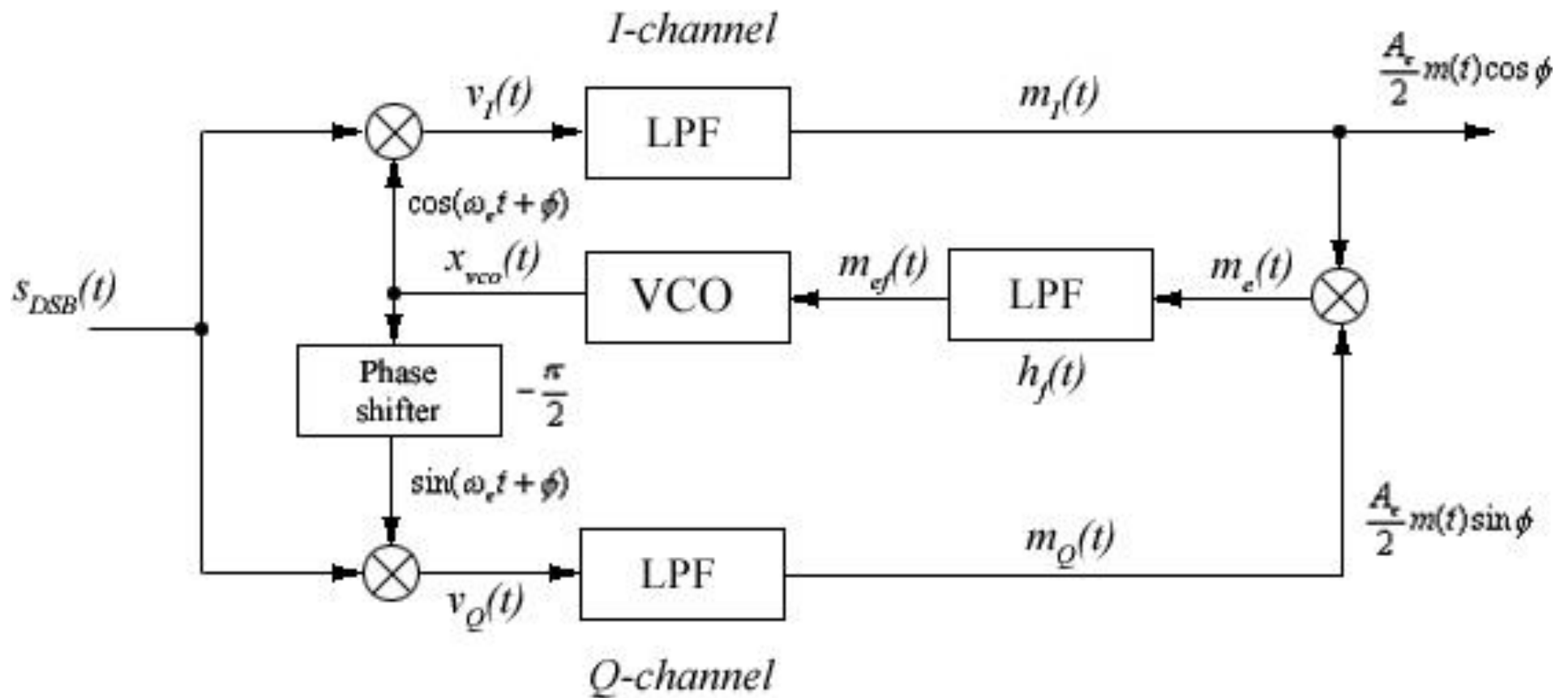
DSBSC RECEIVER CIRCUIT COSTAS LOOP

Electronics & Communication Engg. Dept.

School of Engineering & Technology

CUTM

Coherent Costas loop receiver for DSB-SC :



I-channel:

After down conversion,

$$\begin{aligned}v_I(t) &= A_c m(t) \cos(\omega_c t) \cdot \cos(\omega_c t + \phi) \\ &= \frac{A_c}{2} m(t) [\cos(2\omega_c t + \phi) + \cos \phi]\end{aligned}$$

At the output of the lowpass filter, with $|H(0)| = 1$,

$$m_I(t) = \frac{A_c}{2} \cos \phi \cdot m(t)$$

Q-channel:

$$v_Q(t) = \frac{A_c}{2} m(t) [\sin(2\omega_c t + \phi) + \sin \phi]$$

$$m_Q(t) = \frac{A_c}{2} \sin \phi \cdot m(t)$$

Feedback path:

At the output of the multiplier,

$$\begin{aligned} m_e(t) &= \frac{A_c^2}{4} m^2(t) \sin \phi \cos \phi \\ &= \frac{A_c^2}{8} m^2(t) \sin 2\phi \end{aligned}$$

At the output of the lowpass filter,

$$m_{ef}(t) = \int_{-\infty}^{\infty} m_e(\tau) h_f(t - \tau) d\tau$$

The purpose of $h_f(t)$ is to smooth out fast time variations of $m_e(t)$

The output of the VCO is described by

$$x_{VCO}(t) = \cos(\omega_c t + \phi)$$

Where ω_c is the VCO's reference frequency and $\phi(t) = k_v \int_0^t m_{ef}(\tau) d\tau$, is the residual phase angle due to the tracking error. The constant k_v is the frequency sensitivity of the VCO in rad/s/volt

The instantaneous frequency in radians/sec of the VCO's output is given by

$$\frac{d[\omega_c t + \phi(t)]}{dt} = \omega_c + k_v m_{ef}(t),$$

Clearly, if $\phi(t)$ were small, then the instantaneous frequency would be close to ω_c and the output of the I-path would also be proportional to $m(t)$.



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THANK YOU.....