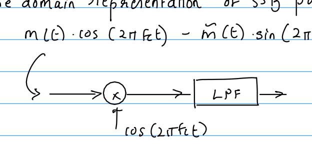
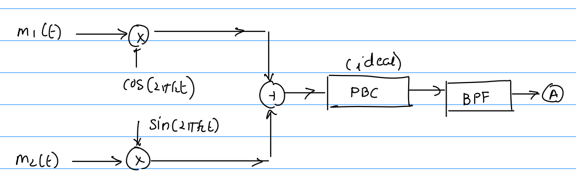
Review.

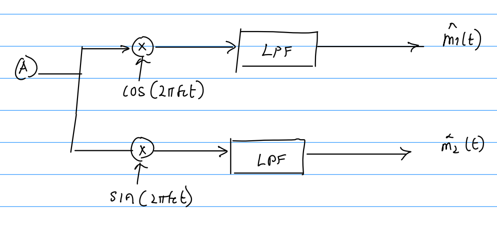
- Time domain representation of SSB passband signal.

$m(t)\cdot\cos(2\pi f_c t) - \tilde{m}(t)\cdot\sin(2\pi f_c t)$



Quadrature carrier multiplexing.





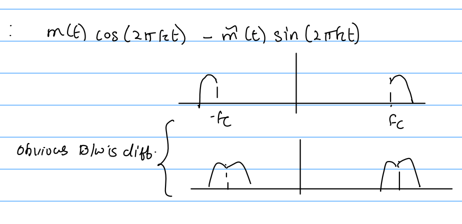
$$\underbrace{m_1\cos(2\pi f_c t)\cdot\sin(2\pi f_c t)}_{2f_c\ \times} + m_2(t)\sin^2(2\pi f_c t).$$

$\frac{m_2(t)}{2}$ ✓ $-$ $2f_c$ ✗

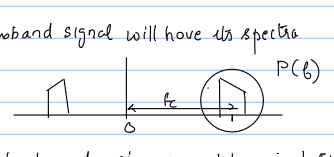
Advantage : of using the same channel B/w to send two signals.

Complex baseband representation of passband signals

Recall SSB : $m(t)\cos(2\pi f_c t) - \tilde{m}(t)\sin(2\pi f_c t)$

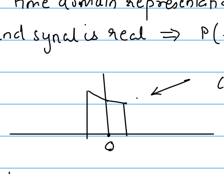


A general passband signal will have its spectra

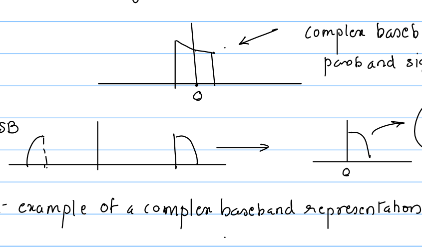


write down its time domain representation just like SSB.

General passband signal is real $\Rightarrow P(-f) = P^*(f)$

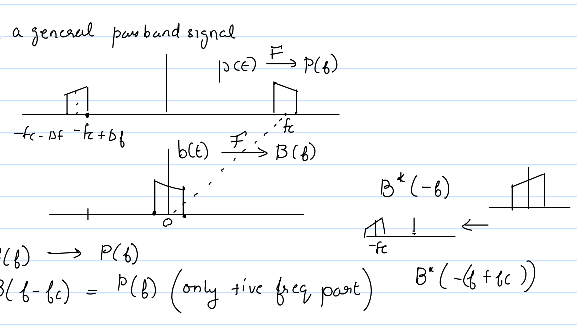


in SSB



first example of a complex baseband representation of a passband signal.

consider a general passband signal



$B(f) \longrightarrow P(f)$

$B(f-f_c) = P(f)$ (only +ive freq part) $\qquad B^*(-(f+f_c))$

how to construct the -ive freq part ?

$P(-f_c) = P^*(f_c) = B^*(0)$

$P(-f) = P^*(f) = B^*(-f+f_c)$ ✗

for $f \le 0$ $\quad P(f) = B^*(-f-f_c)$ ✓

a) $f = -f_c = B^*(0)$ ✓

b) $f = -f_c+\Delta f = B^*(f_c-\Delta f-f_c)$
$= B^*(-\Delta f)$ ✓

c) $f = -f_c-\Delta f = B^*(f_c+\Delta f-f_c)$
$= B^*(\Delta f)$

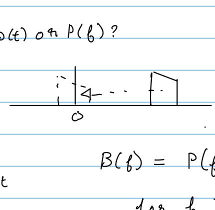
$f \ge 0 \quad P(f) = B(f-f_c)$

$f < 0 \quad P(f) = B^*(-f-f_c)$

$$P(f) = B(f-f_c) + B^*(-f-f_c)$$

how to get $b(t)$ or $B(f)$ from $p(t)$ or $P(f)$?

$(p(t) + j\tilde{p}(t)) \longrightarrow$



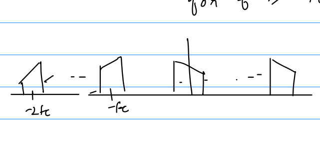
$\times$

$e^{-j2\pi f_c t}$

$(p(t) + j\tilde{p}(t))e^{-j2\pi f_c t}$

$B(f) = P(f+f_c)$

for $f \ge -f_c$



Why do we do this ?

1) every signal can be thot of at baseband.

2)