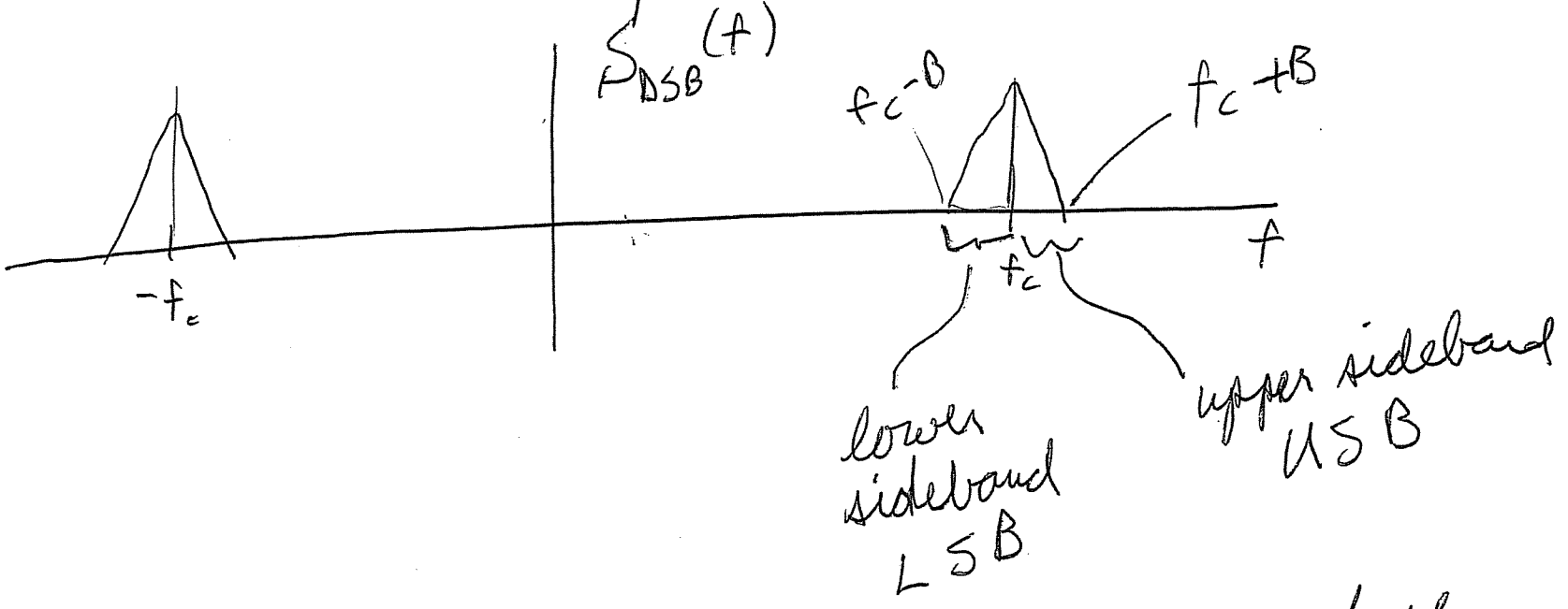
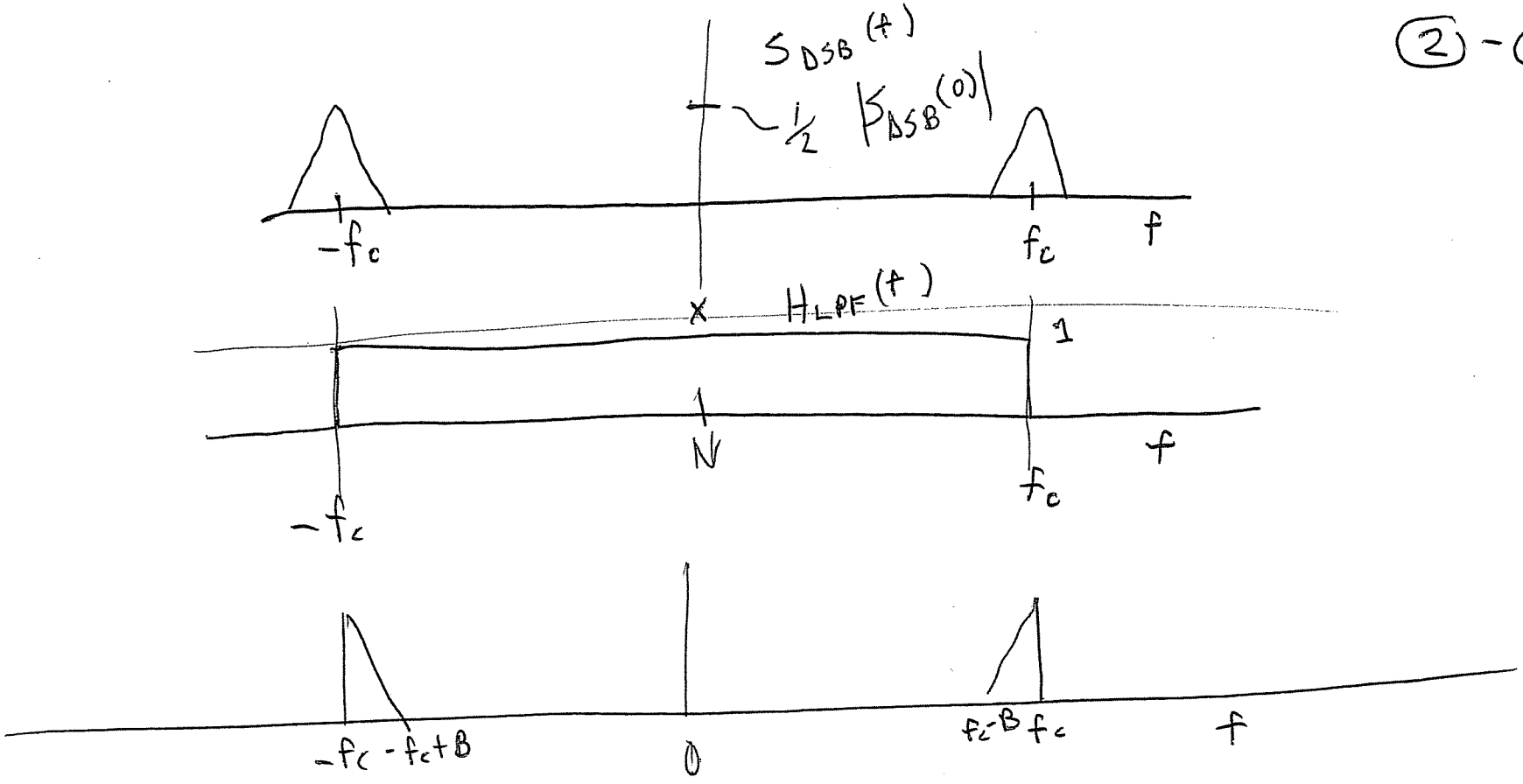
EE 511 : Lecture 15

Single Side Band Suppressed Carier (SSBSC)

The DSBSC is redundant



Consider the concept of SSBSC where we start with a DSBSC signal $s_{DSB}(t)$

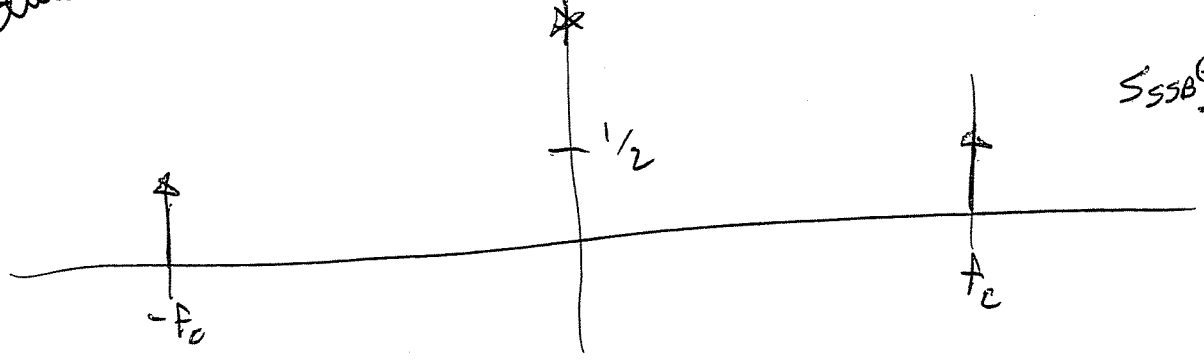


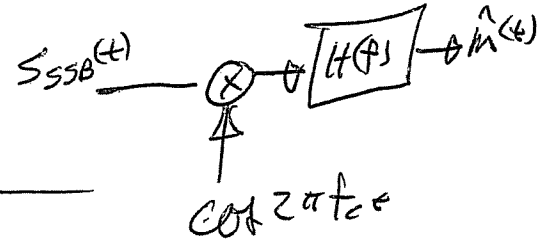
where $S_{SSB}(t) = S_{DSB}(t) * h_{LPF}(t)$ where

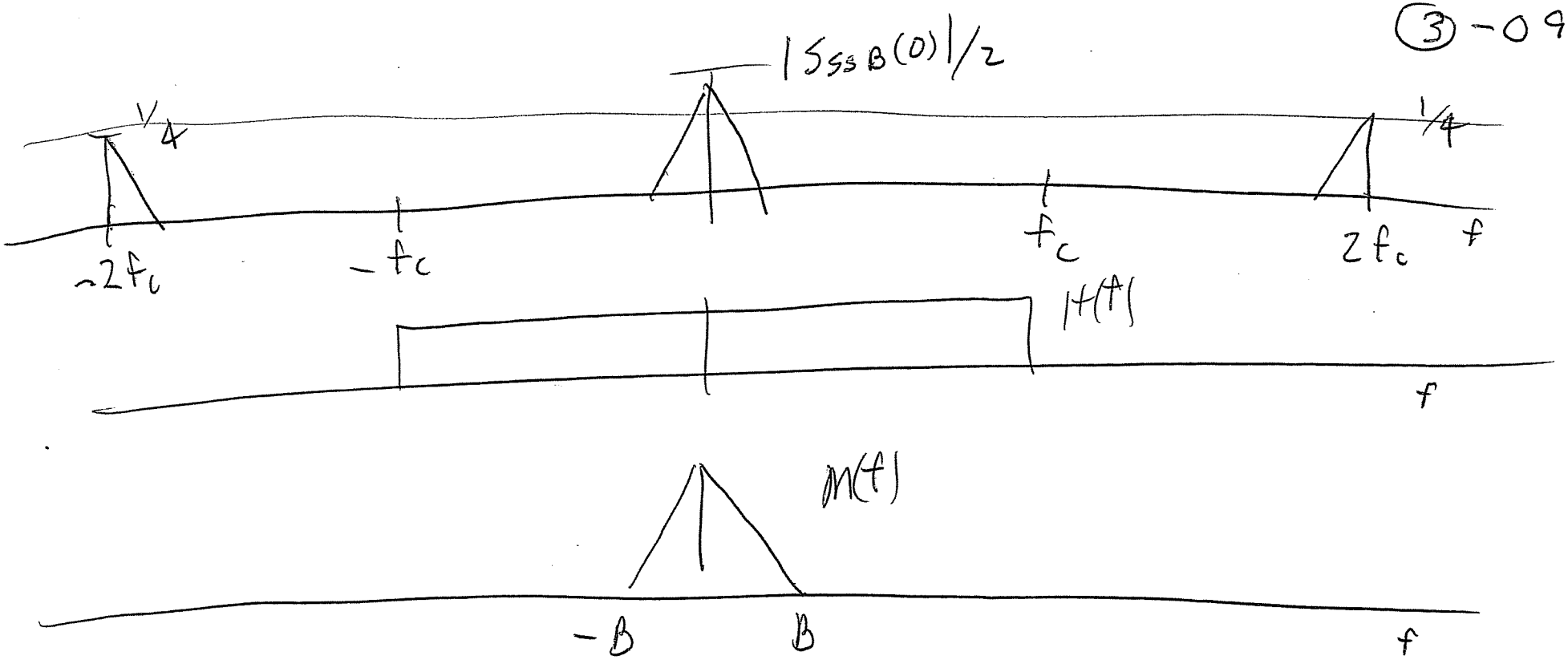
$h_{LPF}(t) = h_{LS}(t)$

where "LS" = lower sideband

Let's demodulate same as DSB

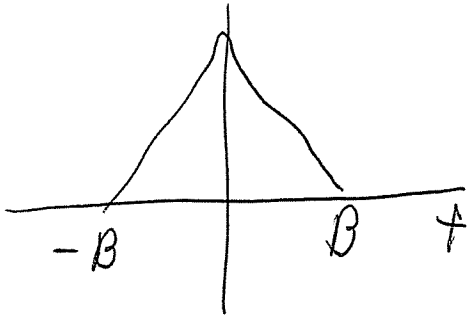






Generate a SSB modulated signal using an intermediate frequency

Given $m(t)$ s.t. $M(f) =$

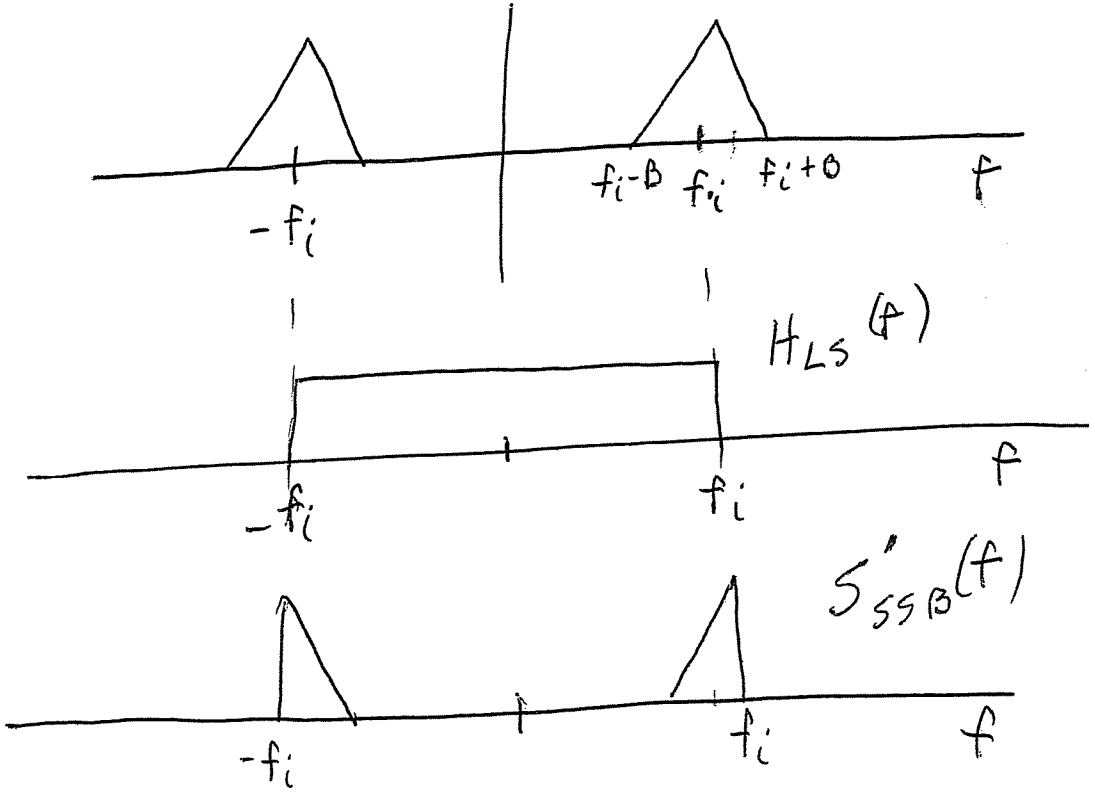


An intermediate signal is generated at

$$s_i(t) = \cos(2\pi f_i t) \text{ where } f_i > B$$

The first step is

$$s'_{SSB}(t) = (m(t)\cos 2\pi f_i t) * h_{LS}(t)$$

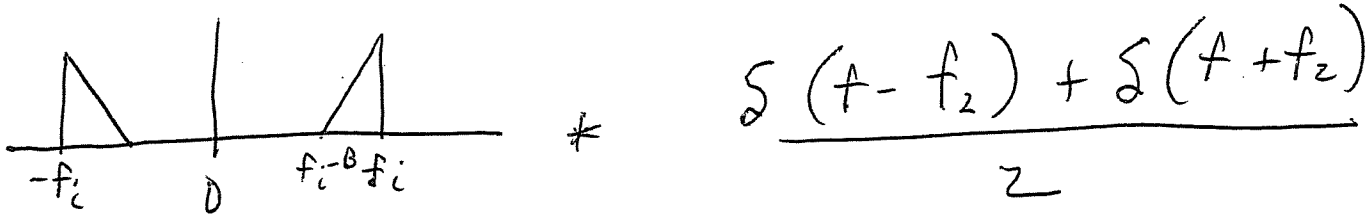


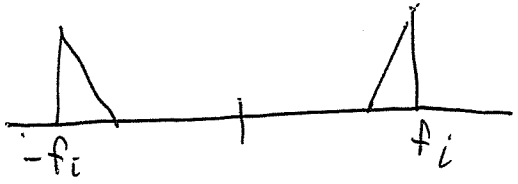
We would like our SSB to be located at f_c

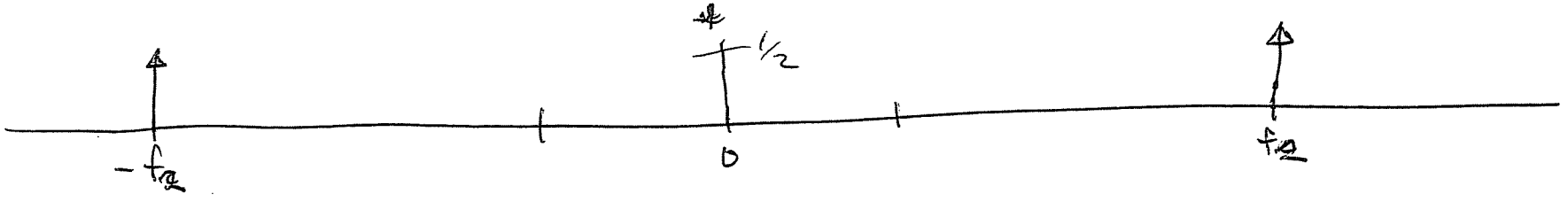
Let $f_2 + f_i = f_c$ so $f_2 = f_c - f_i$

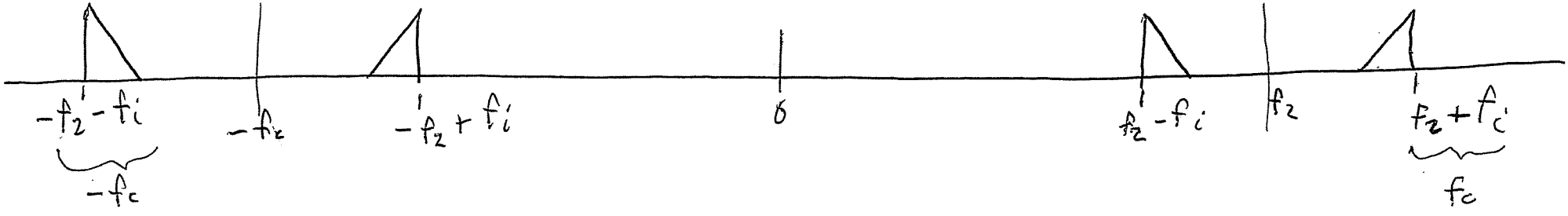
modulate $\cos 2\pi f_2 t$ with the intermediate SSB

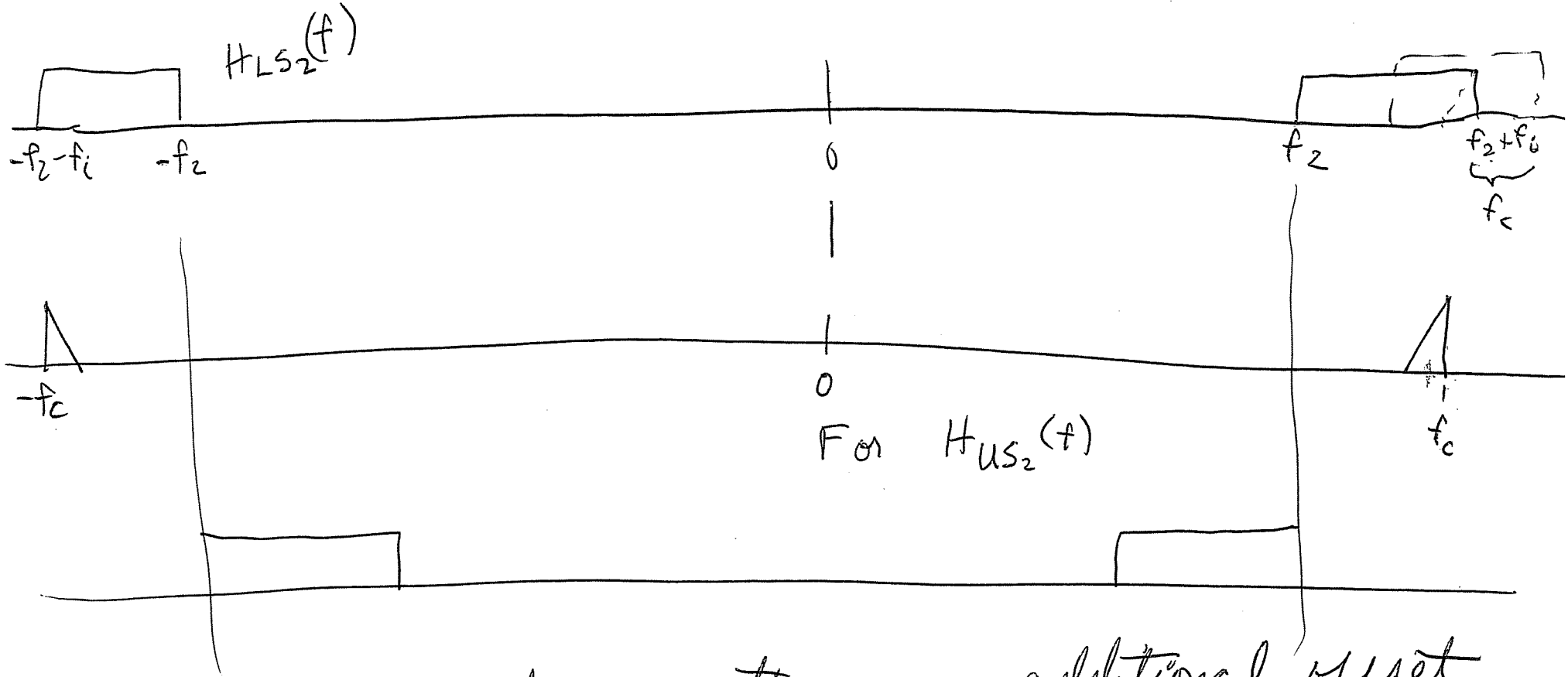
$$s_{SSB}(t) = \left(s'_{SSB}(t)\cos 2\pi f_2 t\right) * h_{LS_2}(t)$$



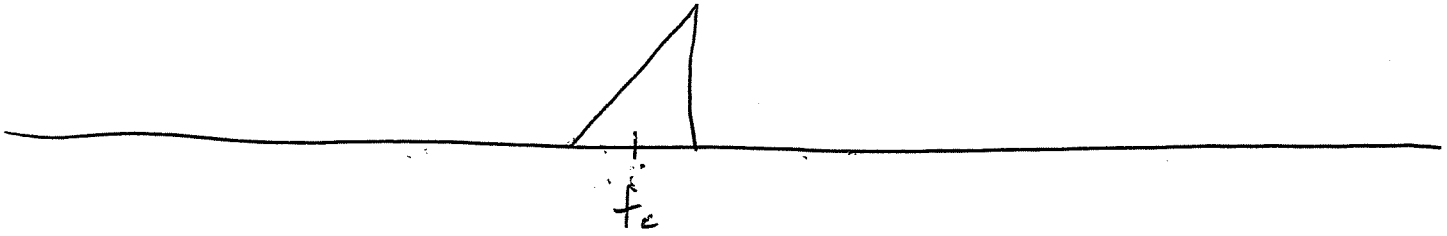




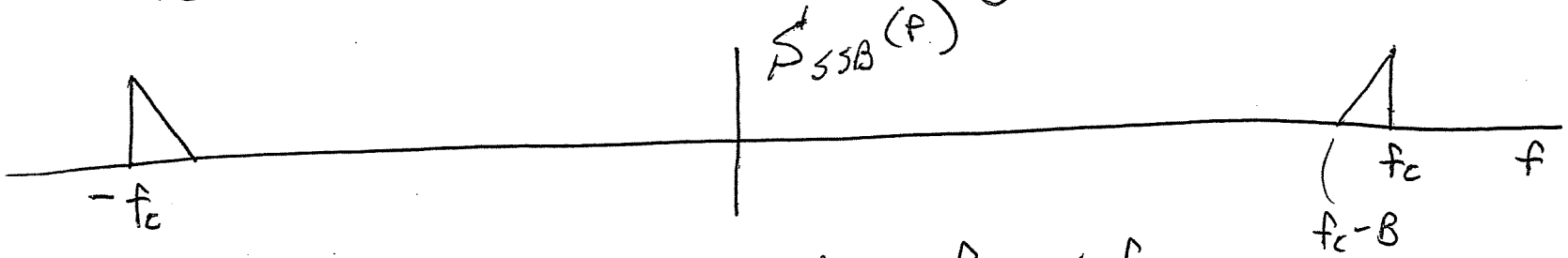




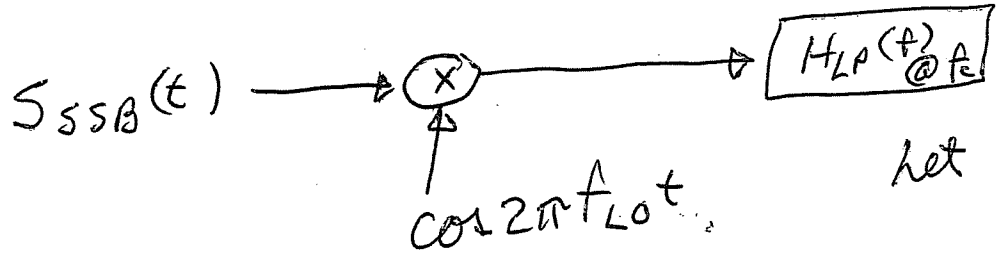
NOTE: In practice an additional offset is implemented such that



Demodulate SSB using IF

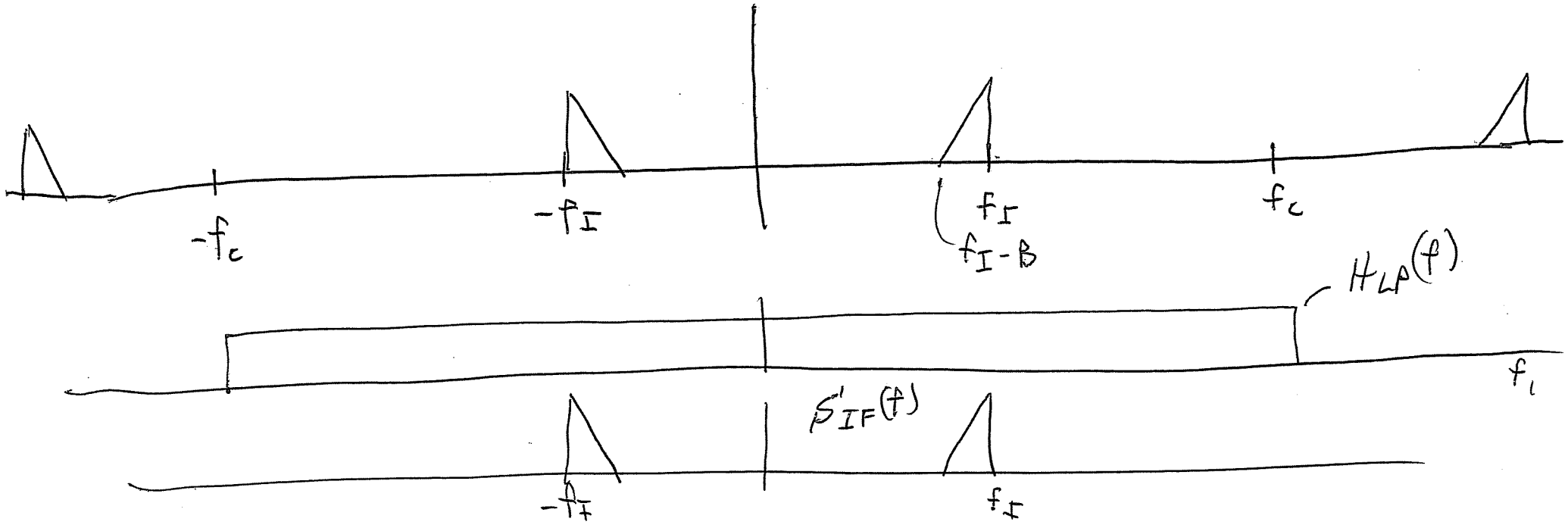


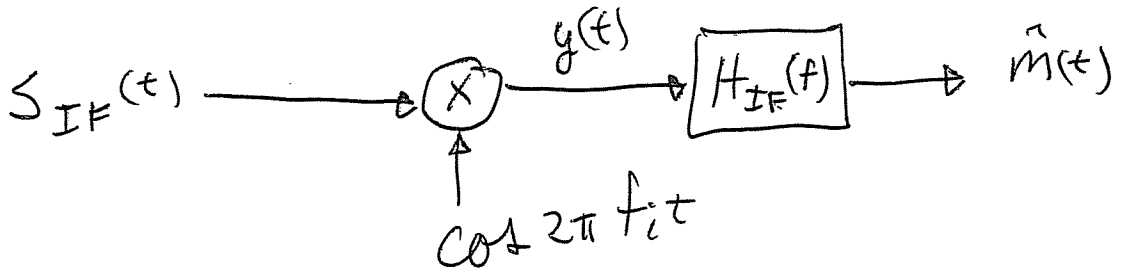
Let us Lowside $f_{LO} < f_c$

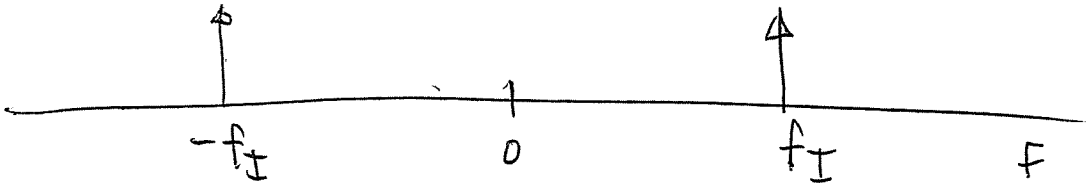


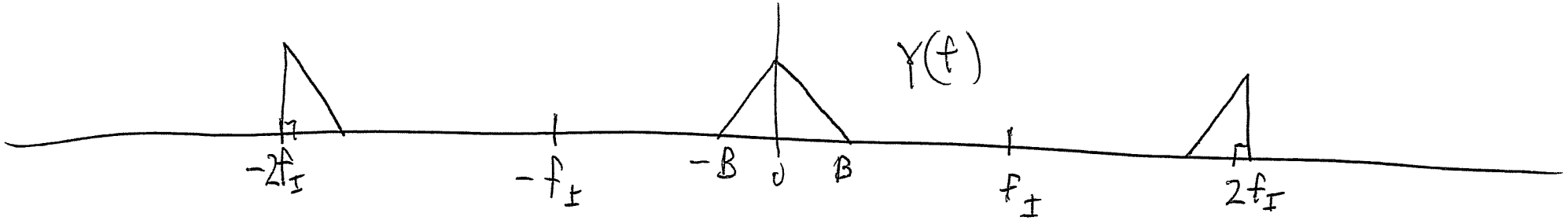
let $f_I = f_c - f_{LO}$

$f_{LO} = f_c - f_I$

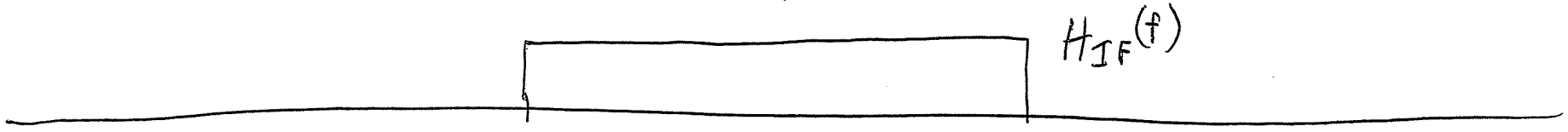


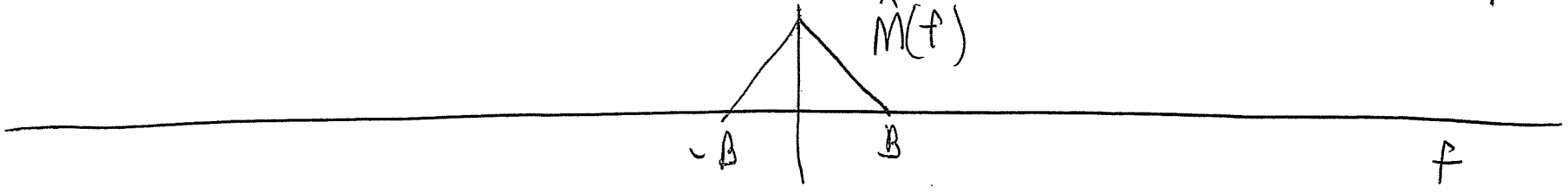

$s_{IF}(t)$
×
$y(t)$
$H_{IF}(f)$
$\hat{m}(t)$
$\cos 2\pi f_i t$


$-f_I$
0
f_I
f


$Y(f)$
$-2f_I$
$-f_I$
$-B$
0
B
f_I
$2f_I$

×


$H_{IF}(f)$
f


$\hat{M}(f)$
$-B$
B
f