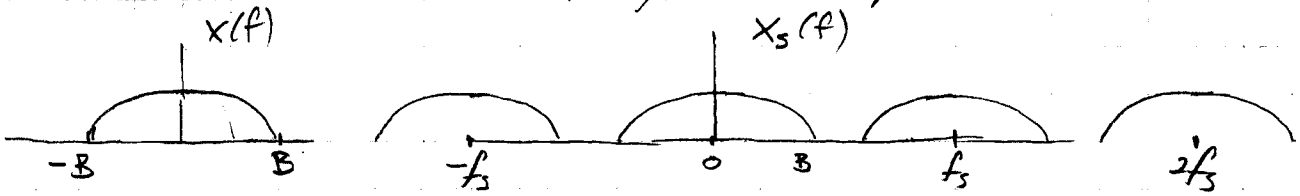
2.3 Sampling Theorem

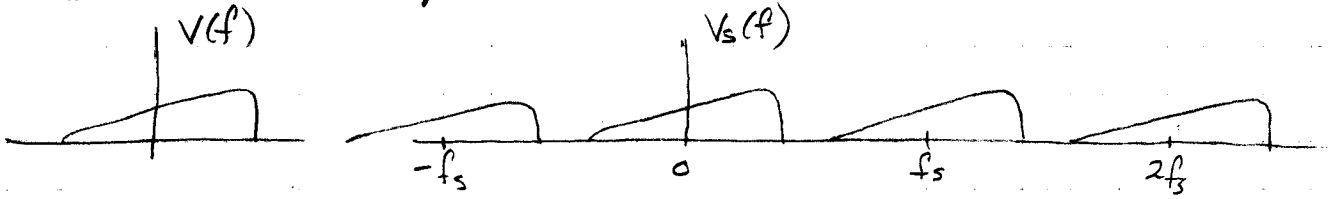
- Remember impulse sampling a real process $x(t)$...



$$x_s(t) = x(t) \circledast \sum_k \delta(t - k/f_s)$$

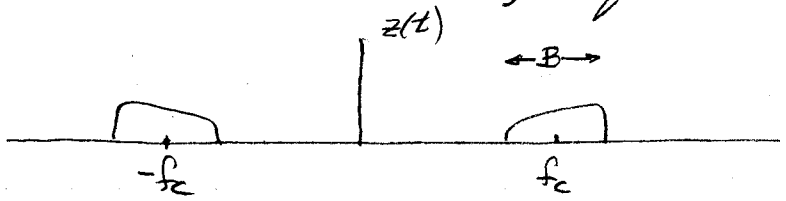
minimum $f_s = 2B$ real samples per second

- What about complex $v(t)$?



Still sample at $f_s \geq 2B$, but take complex samples (2 reals). This reflects the extra information in non symmetric $V(f)$.

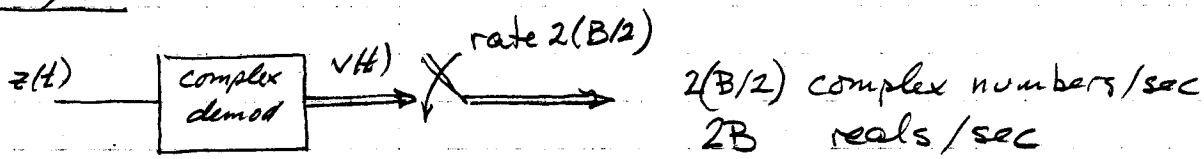
- Now look at sampling requirements for bandpass signals



note bw def'n "positive freq occupancy

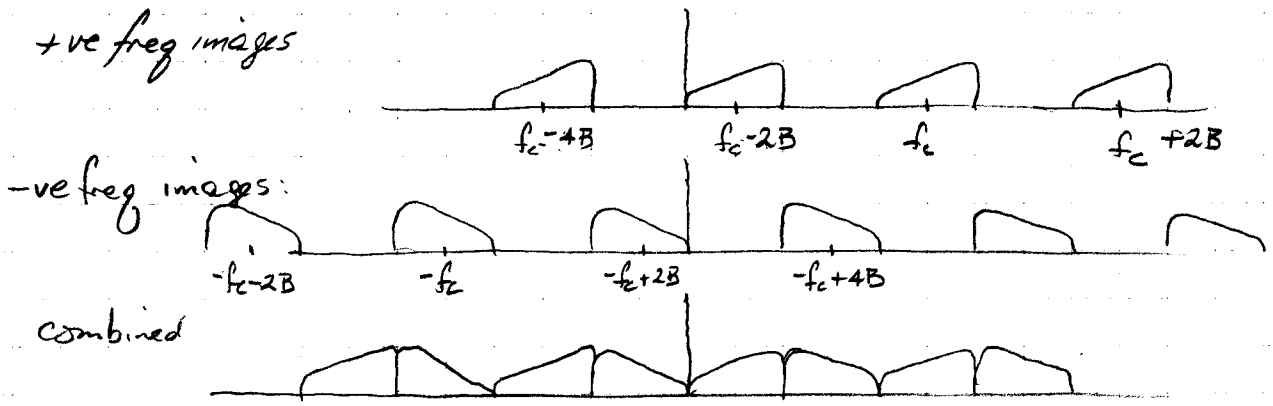
Do we need $f_s \geq 2(f_c + B/2)$?? No.

Proof 1



Proof 2

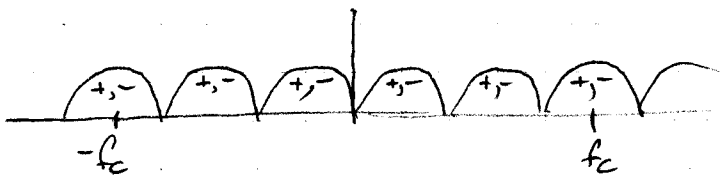
If we take real samples of z(t) at rate 2B,



Information is preserved with 2B reals/sec.

Note pitfall:

looks as if $f_s = B$ will do...



but the + and − images overlap and we lose information.

- Conclude:- In general, need 2B real numbers/sec to represent a real bandlimited signal.