✳ How come we can do perfect band-limited reconstruction

Ans: When the movement of the steering wheel is limited, there is only one route to drive through all the sampling points.
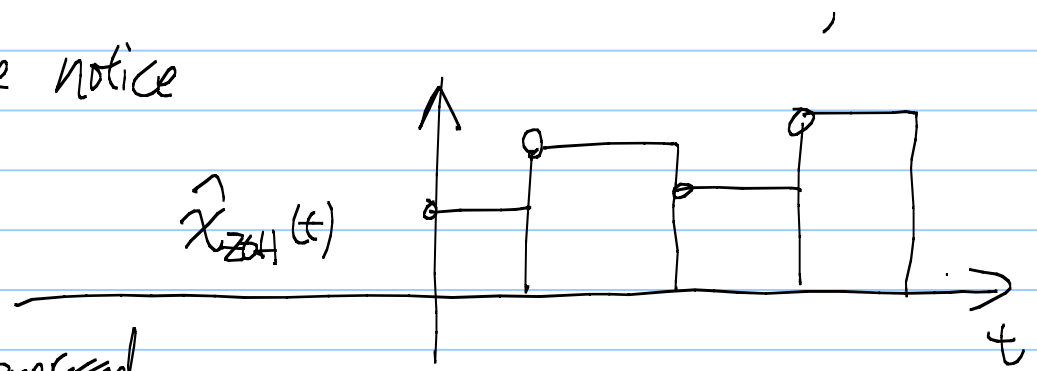

✳ The conceptual ITS $x_p(t)$ helps us devise the ideal band-limited interpolation.

And it also helps us to analyze the non-ideal reconstruction

Ex: The Zero-Order Hold

If we define

then we notice

$\hat{x}_{ZOH}(t)$

can be expressed as

For comparison, the optimal reconstruction is $\hat{x}_{opt}(t)$

also

ZOH is $\wedge$ trying to keep the center copy of the freq spectrum while suppressing side copies.

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But not all side copies can be completely suppressed.

* Linear Interpolation
Define $h_1(t) =$

then we notice

~~therefore~~ we have

By the same reason as the ZOH derivation

Q: What is $H_1(j\omega)$? (Direct Computation)

The $(\quad)^2$ further suppresses the side copies (the freq with zero gain), which thus gives better approximation of the original signal.

We now know that when $W_s > 2W_m$, reconstruction can be perfect.

However, in practice, we can only directly sample $x(t)$. What will happen when the original bandwidth is too large $W_m > \frac{W_s}{2}$?