**Sampling & Re-construction**

Let’s say we have a signal f(t) at frequency f0, it spectrum looks like this:

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We then sample the analog signal f(t) with ADC to obtain discrete digital data stored on e.g. FPGA, and then convert the digital data back to analog with DAC with zero-order hold. Following figure illustrate zero-order hold operation.

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Now, if we measure the output signal of DAC with oscilloscope, and then plot its spectrum, we see something like shown below. Among all the green spikes, only one of them is our original signal f(t), the rest is its images. Also, the entire spectrum is modulated by sinc envelope. Why DAC’s spectrum looks like this?

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To see the spectrum of (t) we can take its Fourier transform. First, Write (t) as superposition of blocks:

Take Laplace transform (more general version of Fourier transform):

Take inverse Laplace transform of F\*(s):

Take Laplace transform again:

Where F(s) is the spectrum of f(t). So,

The figure below shows v.s. .

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