Chynelle Ziarah C. Villostas Lab Output - Fourier Transform

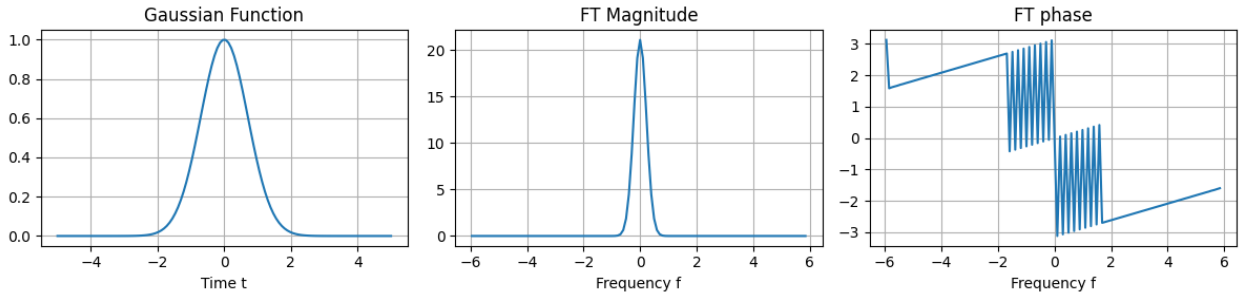

Figure 1: Gaussian function as an input signal with the Fourier Transform

For a gaussian function, the Fourier transform produced is also a gaussian. However if we vary σ, we find that the effect is opposite on the transform - that is, a wider gaussian makes for a narrower transform vice versa.

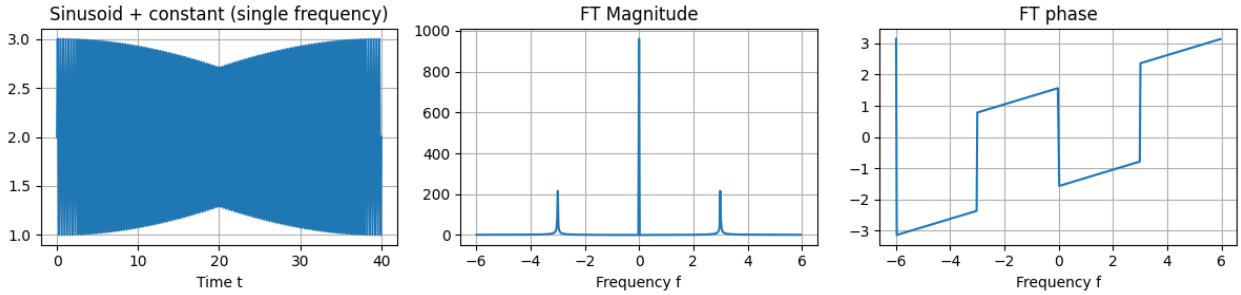

Figure 2: Sinusoid function as an input signal with the Fourier Transform

For a sinusoid, the Fourier transform produces two peaks at $\pm f$. Varying the frequency f moves the spectral lines or the bump that you can see on the graph to where you set said frequency (i.e. in the graph above the frequency is set to $f = 3$, so the spectral lines are found at ± 3).

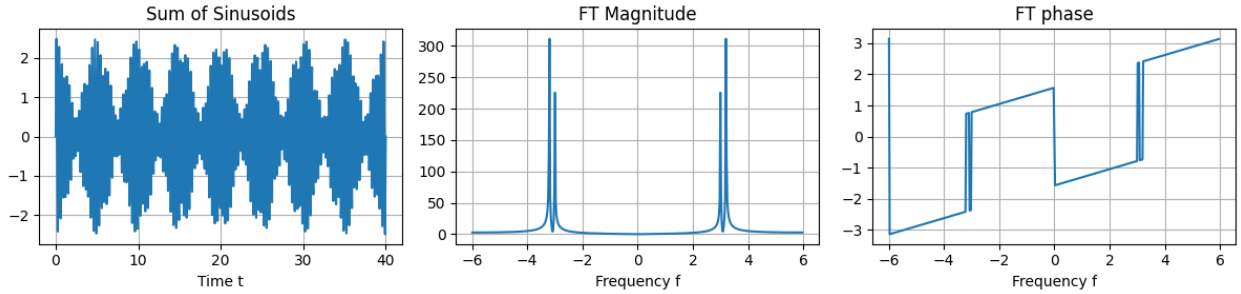

Figure 3: Sum of sinusoids as an input signal with the Fourier Transform

For a sum of two sinusoids, the number of peaks or spectral lines increase since the Fourier transform will show the frequency f_1 and f_2 of the two added sinusoids. Just like in a single sinusoid, varying the frequencies f_1 and f_2 simply moves the spectral lines to where the frequencies were set.

For a product of two sinusoids, the spectral lines produced appear at the sum and difference of the frequency. And this is thanks to the trigonometric identity for the product of two sinusoids. Varying the frequency then, just like the two previous sinusoidal functions simply moves the spectral lines.

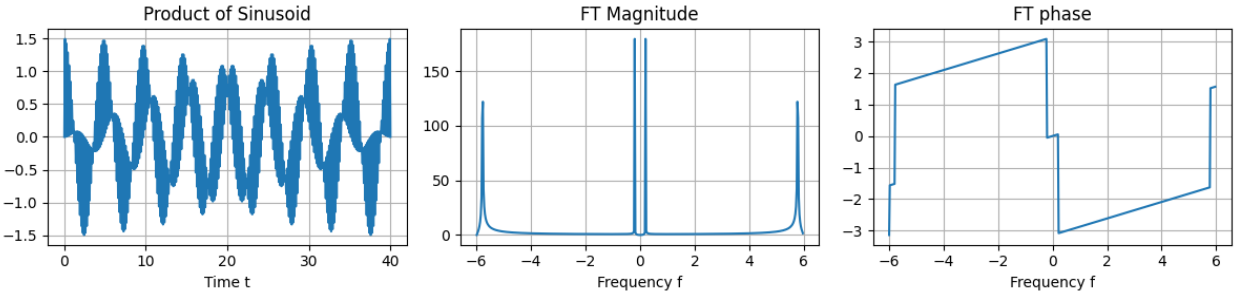

Figure 4: Product of sinusoid as an input signal with the Fourier Transform

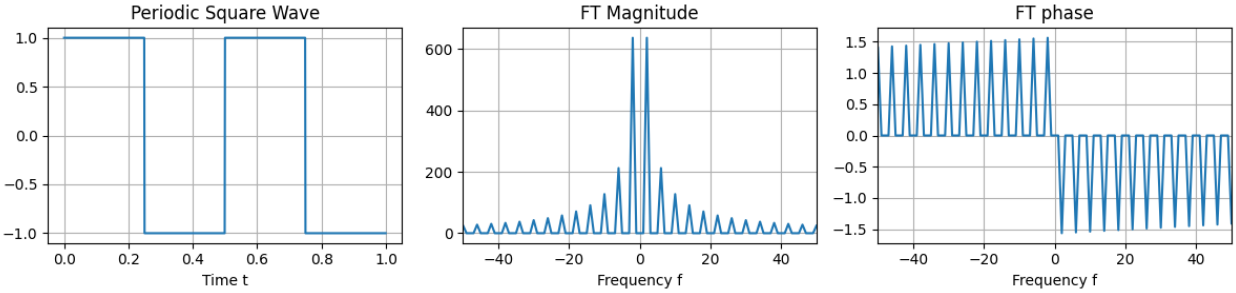

Figure 5: Periodic square wave as an input signal with the Fourier Transform

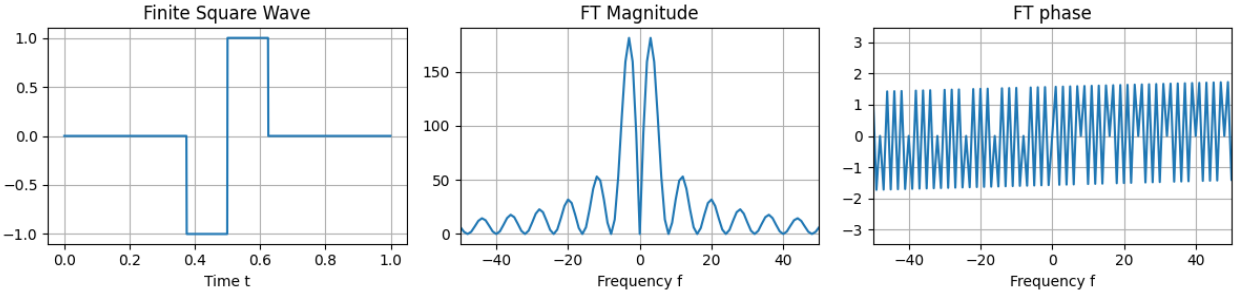

Figure 6: Finite square wave as an input signal with the Fourier Transform

For both the periodic and finite square wave, increasing the pulse width makes for a narrower spike in the Fourier transform.

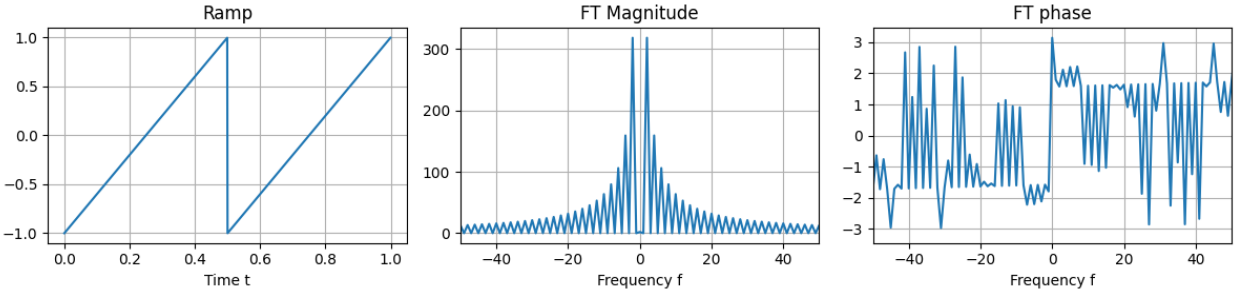

Figure 7: Ramp wave as an input signal with the Fourier Transform

For all three types of the triangle wave, we find that making the edges steeper makes the transform have higher frequency harmonics. Also, for the ramp and the reverse ramp the FT magnitude is he same, however their phases are reversed. And also the ramp and reverse ramp transform contains all the harmonics, while the sawtooth contains only odd harmonics.

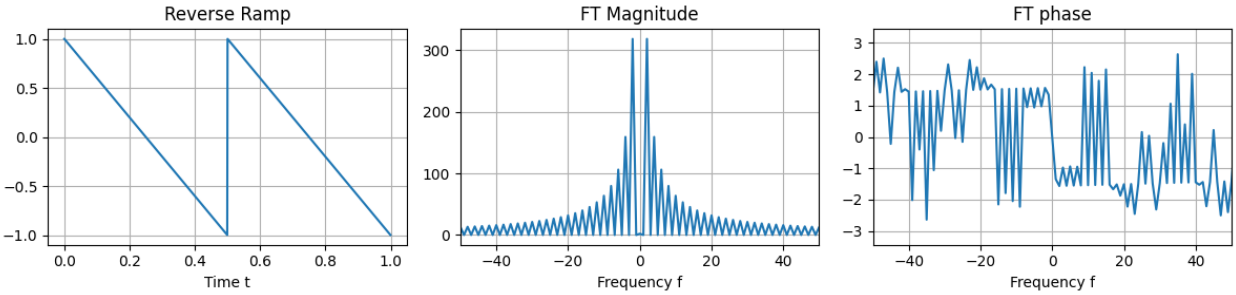

Figure 8: Reverse ramp wave as an input signal with the Fourier Transform

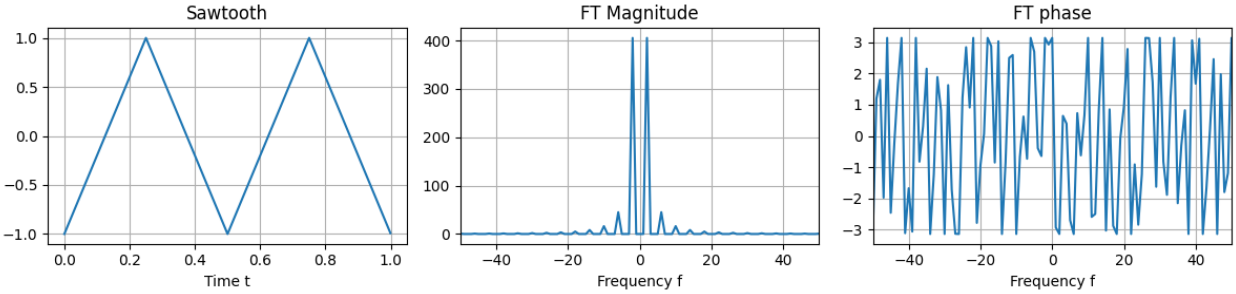

Figure 9: Sawtooth wave as an input signal with the Fourier Transform

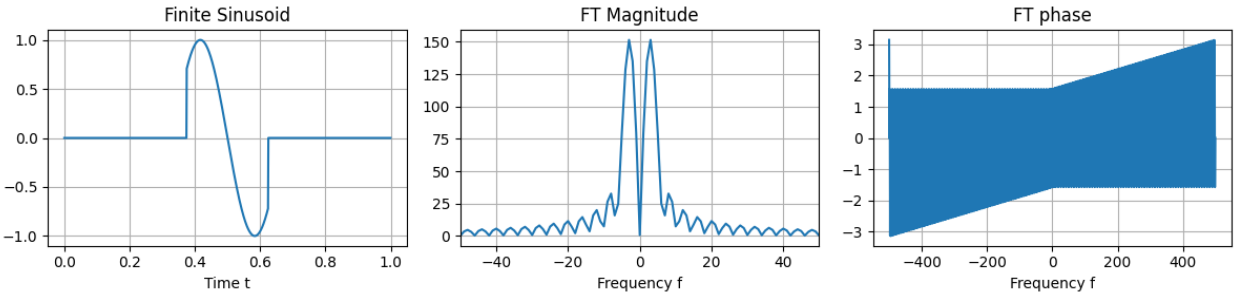

Figure 10: Finite-time sinusoid function as an input signal with the Fourier Transform

For a finite-time sinusoid, varying the duration of the time affects the frequency of the FT. Particularly, a decreased (shorter) duration makes for a wider spectrum, vice versa.

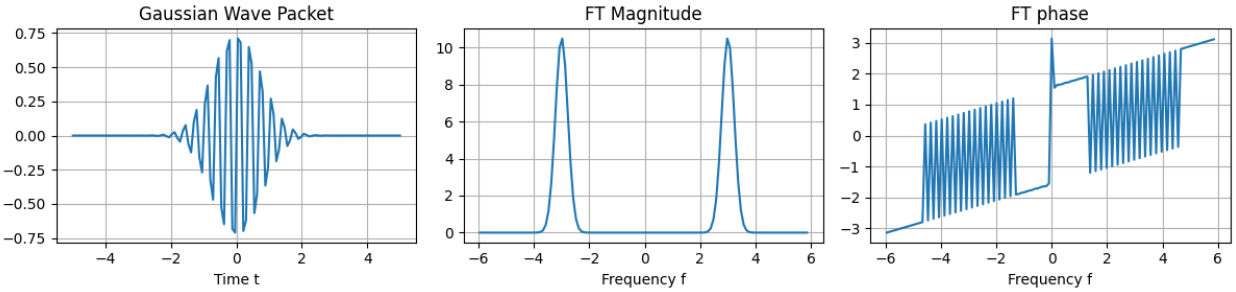

Figure 11: Gaussian wave packet as an input signal with the Fourier Transform

Finally, for a gaussian wave packet, a larger σ makes for a narrower gaussian at the set frequency, vice versa. Since this is essentially just a sinusoid inside a gaussian envelope, the Fourier transform is just like that of the previous discussed sinusoids, only here, instead of a spectral line, we have a gaussian at the set frequency.