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**HW 2: Square pulse train and its spectrum**

To define the square pulse train, the user needs to input the pulse’s amplitude, period, duty cycle, sampling frequency and time length of signal. The time between samples, ‘dt’, is calculated by taking the inverse of the sampling frequency. In the frequency domain, the frequency step size is calculated by taking the inverse of the time length of the signal. I defined the total number of samples to be 61, encompassing just over two periods of the signal. This allowed for a better representation of the signal’s spectrum when taking samples. One square pulse can be represented as follows:

where *c* is the signal, *a* is the amplitude, *t* is the time vector, and *T* is the pulse width. Matlab has a function, square, that enables the user to input a duty cycle as well, generating a pulse train. It is known that the Fourier transform of a single square pulse is a sinc function in the form,

where *C* is the frequency domain representation of *c* and *f* is the frequency. For finding the finding the Fourier series representation of the sampled pulse train however, we start with the Fourier series definition:

where *X* is the frequency domain representation of the square pulse train, *k* is the index, *N* is the number of samples in a period, and *N1*bounds the edges of a single square pulse on either side of zero. Carrying out this computation, it can be seen that

The sampled square pulse train and its spectrum can be seen in the plots below:

