General Physics Notes (07232026):

Fourier transforms are some of the most powerful tools physicists have for wave analysis, pattern recognition, deconvolutions, and frequency space decomposition. Although there are more advanced waveforms out there (Hilbert space filling curve, Mandelbrot set, Serpinski carpet, Cantor dust, etc.) a very good understanding of the wave is from the second order recursion and then the integral transform of the space and time derivatives and formations. Advanced wave shapes will also be subjected to the Fourier transform and its uses in phased array radar, lock-in amplification, digital circuitry, telecommunications, data centers, and more is just beginning to be realized. New integral transformations inspired by the Fourier transform and utilizing new zeta function calculus will impart a physicalism into the abstract nature of the integral relation. Eventually, this will become something more like a branch of physics in itself, with new waveforms and shapes being studied, from multi-dimensional Platonic polytopes to scale invariant fractional dimensional curves. We'll review some basic notes.

$$\tilde{f}(k) = \int_{-\infty}^{\infty} f(x) e^{-i2\pi xk} \partial x \quad \forall k \in \mathbb{R} \tag{1}$$

Of course, you can impart some physicalism into the raw calculus and find something that varies with the spacetime coordinate. This is a philosophical approach that can be rewritten.

$$\tilde{f}(k) = \int_{-\infty}^{\infty} f(x) e^{-i2\pi xk} \zeta(x, \frac{1}{k}) \partial x \tag{2}$$

Implications in the zeta approach and zeta calculus arise from a complexity inherent in the complex adaptive system and metadata correlated to the evolutionary physicalism of the equipment undertaking the Fourier transform. Here equipment is the sum total of connected spacetime points in the connected diagram.

Sine and cosine terms with infinite order coefficients usually develop the function, here a Fourier series will have the form as following.

$$f(t) = \sum_{n=1}^{\infty} f_n \cos(\omega_n t) + g_n \sin(\omega_n t) \tag{3}$$