General Physics Notes (08052026):

We'll cover some of the Hilbert space filling curve and see if we can brute force it through some techniques into the wave equation.

$$H = \lim_{n \to \infty} H_n \tag{1}$$

$$H_n : [0,1] \to [0,1]^2 \tag{2}$$

What is happening is the formation of a higher dimensional structure from basic progenitors. Since there are different types of infinity, this can slowly morph from one infinity into a larger higher dimensional infinity. There are lots of debates about the asymptotic behavior of functions. We can discuss analytic continuation as well.

Let's rewrite the wave equation.

$$c^2 \nabla^2 f(x,t) - \frac{\partial^2 f(x,t)}{\partial t^2} = 0 \tag{3}$$

The curve is nowhere differentiable which means it is stereo-graphic everywhere differentiable and completely simple. It behaves in many ways like the exponential wave function solution e^{ix}. When we investigate the wave equation, we are not really looking at waves; we are trying to solve some sort of recursion relation.

Perturbative efforts to change the structure of the Hilbert recursion into something that resembles the wave recursion are necessary. We are solving a second order recursion. General solutions are found like this:

$$f(x,t) = \sum_{n=0}^{\infty} \alpha_n x^n t^n \tag{4}$$

What is nice is that we can separate the time and the position because they are orthogonal, and really all the polynomials are orthogonal. A nice little property. We should get something like:

$$H(f(x,t)) = \sum_{n=0}^{\infty} H_n \alpha_n x^n t^n \tag{5}$$

Modification is also infinite order perturbation theory.

$$H_n = H_0 + \sum_{n=0}^{\infty} \Delta_n \alpha_n x^n t^n \tag{6}$$

You should try to find how a recursion develops and something like:

$$\frac{H_n + H_{n+1}}{H_{n+2} - H_n} = \frac{\alpha_n + \alpha_{n+1}}{\alpha_{n-1} - \alpha_n} \tag{7}$$

It is left as an exercise to verify the recursion. There is not enough time to find the explicit function.