Schrodinger Trig Functions

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Abstract

This paper attempts to fill a hole in our understanding of trigonometric functions. Inspired by parabolic trigonometric functions and the schrodinger equation we define a new class of trigonometric functions.

1 As Differential Equations

In the context of differential equations we can define cosine as the unique solutions to the following system of differential equations. [1]

$$\frac{d^2}{dx^2}f(x) = f(x), f(0) = 1, f'(0) = 0 \tag{1}$$

And we can define sine as the first derivative of cosine. Similarly we may define the hyperbolic cosine function with this differential system. [1]

$$\frac{d}{dx}f(x) = -f(x), f(0) = 1, f'(0) = 0 \tag{2}$$

Recently a new branch of trignometric functions were defined. These parabolic trigonometric functions parameterize the unit palabora. [2] We can define the parabolic cosine with the following differential equation.

$$\frac{d^2}{dx^2}f(x) = 0, f(0) = 1, f'(0) = 0 \tag{3}$$

Now we can define a new class of functions using the following system.

$$\frac{d^2}{dx^2}f(x) = if(x), f(0) = 1, f'(0) = 0 \tag{4}$$

References

[1] Robert G. Bartle and Donald R. Sherbert. *Introduction to Real Analysis*. Wiley, 3rd edition, 1999.

[2] G. Dattoli, M. Migliorati, M. Quattromini, and P. E. Ricci. The parabolic-trigonometric functions, 2011.