Harmonisation of Classical Wave Equation

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Abstract

In [1] I introduced the notion of *harmonisation* which is a technique using which one associates four-wavevector to a wave in terms of the wave-function *itself*. There we showed that this technique yields generalisations of Schrödinger and Klein-Gordon equations which, for a pursuer of truth, were long expected, as the orthodox quantum mechanics applies to incompresssible fluids of probability only. In this short note, we apply the technique to the classical wave equation

$$\frac{1}{c^2}\frac{\partial^2\phi}{\partial t^2} = \nabla^2\phi. \tag{1}$$

to arrive at a novel nonlinear equation.

The necessity of our investigation is thoroughly dicussed in [2]; Drozdov and Stahlhofen have essentially proposed our definition of harmonisation and motivated it from a more pictorial and applied approach; they did not however neither realise its significance in dealing with foundations of quantum mechanics nor its ability to yield a nonlinear classical wave equation.
To arrive at such equation, recall that the constant c (speed of propagation of wave) is given by

$$c = \frac{\omega}{\|\mathbf{k}\|} \tag{2}$$

On the other hand, according to our definition proposed in [1] we have

$$\omega = \frac{i}{\phi}\frac{\partial\phi}{\partial t}, \quad \mathbf{k} = -i\frac{\nabla\phi}{\phi} \tag{3}$$

therefore

$$\frac{1}{c^2} = \frac{\|\nabla\phi\|^2}{(\frac{\partial\phi}{\partial t})^2} \tag{4}$$

Substitution in (1) yields

$$\boxed{\|\nabla\phi\|^2\frac{\partial^2\phi}{\partial t^2} = (\frac{\partial\phi}{\partial t})^2\nabla^2\phi} \tag{5}$$

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The aesthetic aspect of this equation is of particular interest to me: it has a perfect symmetry between squares, and it has no constant. If this proposed equation proves to be viable it will shed light on the arguments in[2] regarding the statement that the classical wave equation (1) stands only from a *far-field approximation* view.

References

[1] Alireza Jamali. Nonlinear generalisation of quantum mechanics. *Preprints*, 2021(2021080525), 2021.

[2] I. V. Drozdov and A. A. Stahlhofen. On a local concept of wave velocities. *arXiv:math-ph/0612023*, 2018.