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Abstract

The model of the vibrating string will consist of a PDE (wave equation) and additional conditions. To obtain the PDE, we consider the forces acting on a small portion of the string (Fig. 286). This method is typical of modeling in mechanics and elsewhere.

Contents

1. Introduction

We continue our work from Sec. 12.2, where we modeled a vibrating string and obtained the one-dimensional wave equation. We now have to complete the model by adding additional conditions and then solving the resulting model. The model of a vibrating elastic string (a violin string, for instance) consists of a onedimensional wave equation.

2. Results

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2} \qquad c^2 = \frac{T}{\rho} \tag{1}$$

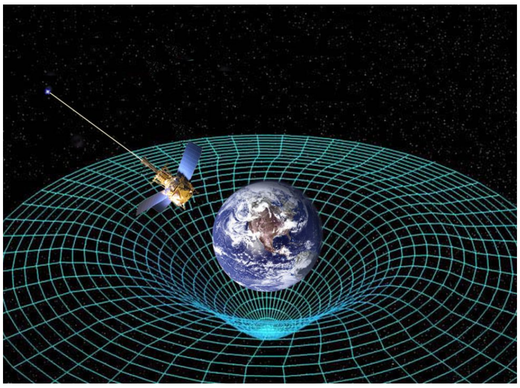
$$\frac{\partial^2 u}{\partial t^2} = F\ddot{G} \quad \text{and} \quad \frac{\partial^2 u}{\partial x^2} = F''G \tag{2}$$

$$u_n(x,t) = (B_n \cos \lambda_n t + B_n^\star \sin \lambda_n t) \sin \frac{n\pi}{L} x \qquad (n = 1, 2, \cdots). \tag{3}$$

$$\sin \frac{n\pi x}{L} = 0 \quad \text{at} \quad x = \frac{L}{n}, \frac{2L}{n}, \cdots, \frac{n-1}{n} L, \tag{4}$$

$$F = Ae^{\mu x} = Be^{-\mu x} \tag{5}$$

3. Conclusion



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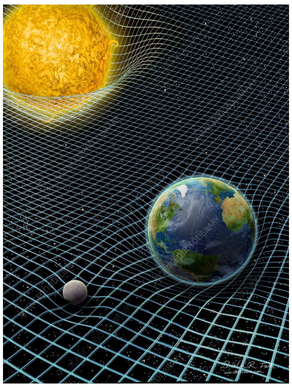

4. Acknowledgements

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5. References

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