Mathematics application in sound propagation modelling in sea water

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Abstract
Mathematics is an important science in Calculations related to professional and researching subjects[٢]. Sound propagation in sea water and its applications is being important and more important in science researching and fisheries tomography and solitary fronts[٤]. In this article, we are following the importance of mathematical solutions to problems related to sound propagation in sea water. The wave equation is solved and noise directionality is modelled from distributed surface noise sources over a uniformly sloping sea bed taking account of multipaths. With paying attention to this article and those similar, we will understand the importance of mathematics in calculations related to sound propagation systems and their applications.

Keywords: math, sound, propagation, modeling.

Introduction
For being successful in facing with scientific, searching and professional section dependent on sound propagation in sea water, we must apply mathematical methods and theories. Numerical methods such as finite differences or finite elements are becoming increasingly popular in obtaining solutions to the elastic wave equation without making these assumptions. However, different methods frequently produce different results for the same problem, and it is essential to confirm the validity of a particular method before placing confidence in the results. Noise directionality (noise power per unit solid angles as a function of angle) is an important quantity for determining array performance. Directly multiplying it by and array's steered beam pattern and integrating over all angles gives the array's noise response for that steer direction[٣]. Sound as a mechanical wave propagates more rapidly in sea water rather than in air. We use sound signals in sea water for different purposes.We use mathematical calculations and formulas to problems related to it.Using this method, we coat the searches on application of sound propagation more better[٥].

Wave equation
Because of the simplicity and speed, a particular finite difference code can be greatly improved by judiciously simplifying the elastic wave equation, a number of different wave equations are treated by ismologists[٦]. Some of the wave equations which have been used for finite difference work are listed below:

$$\rho\ddot{u}=(\lambda+\mu)\nabla(\nabla.u)+\mu\nabla^{٢}u+[\nabla\lambda(\nabla.u)+\nabla\mu\times(\nabla\times u)+٢(\nabla\mu.\nabla)u]$$

$$\rho\ddot{u}=\lambda\nabla(\nabla.u)+[\nabla\lambda(\nabla.u)]=\nabla(\lambda\nabla.u)$$

$$\rho P=\lambda\nabla^{٢}p+[(\lambda\rho\nabla(١/\rho).\nabla p]=\lambda\rho\nabla.((١/\rho)\nabla p)$$

$$\rho V=\mu\nabla^{٢}V+[\nabla\mu.\nabla V]=\nabla.(\mu\nabla V)$$

$$-\rho\omega^{٢}\hat{u}=(\lambda+\mu)\nabla(\nabla.\hat{u})+\mu\nabla^{٢}\hat{u}+[\nabla\lambda(\nabla.\hat{u})+\nabla\mu\times(\nabla\times\hat{u})+٢(\nabla\mu.\nabla)\hat{u}]$$

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