Virtual Model For Dead Sea Dispersive waves

Khaled Hyasat

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Abstract:

We consider Virtual model for the dispersive waves in the Dead Sea in the Jordan Valley. A brief study about the virtual model was conducted.

Introduction:

Nonlinear wave phenomena are of great importance in the physical world, and have been for a long time a challenging topic of research for both pure and applied mathematicians (focus on analytical and physical aspects of nonlinear wave)

Applications:

- Nonlinear optics
- Long distance communication devices (transoceanic optical fibers, waves in the atmosphere & ocean)
- Turbulence in plasmas
- Useful for operative Geotechnical Consultancy

Wave and Dispersion:

Def. : the standard dispersion – free wave equation is the simplest mathematical model for describing the motion of waves in time

$$\frac{1}{v^2}\frac{\partial^2}{\partial t^2}y(x,t)=\frac{\partial^2}{\partial x^2}y(x,t)$$

Dispersion Relations:

Phase velocity

$$v_p = \frac{\omega}{k}$$

Group velocity

$$v_g \equiv \frac{d\omega}{dk}$$

$$Types:$$

$$\upsilon_p = \upsilon_g \text{ , less}$$

$$\upsilon_p > \upsilon_g \text{ , normal}$$

$$\upsilon_p < \upsilon_g \text{ , anomolus}$$

Examples: (dis., Nondis. waves)
Dis:

- Most waves in material media

- electromagnetic waves in unbounded free space
- sound waves in air (nearly)! Music played by an orchestra w’d not be harmoious

Mathematical Modeling of Waves :

Objective:

- Predict damages
- Find optimal location of breakwaters and other structures for critical coastal areas
- Indicate safe regions
- Employ inverse techniques

Nonlinear Dispersive Equations: PDE that are commonly arise in problems of mathematical physics

- Benjamin-Bona-Mahony

$$u_t + u_x + u u_x - u_{xxt} = 0$$

- Biharmonic

$$\nabla^4 \phi = 0$$

- Boussinesq

$$u_{tt} - \alpha^2 u_{xx} = \beta^2 u_{xxtt}$$

- Korteweg – de Vries

$$u_t + u_{xxx} - 6 u u_x = 0$$

- Korteweg – de Vries - Burger

$$u_t + 2 u u_x - \gamma u_{xx} + \mu u_{xxx} = 0$$

- SchrÖdinger Equation

$$i\hbar \frac{\partial}{\partial t}\Psi = E\Psi$$

- Cauchy- Riemann

$$\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$$

$$\frac{\partial v}{\partial x} = -\frac{\partial u}{\partial y}$$

Shallow Water wave:

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