1)

Notes 63(18). Final Version of the Coulomb Law with Resonance

This is obtained from:

$$\underline{\nabla} \cdot \underline{E} = \rho / \epsilon_0 \quad - (1)$$

and

$$\underline{E} = -(\underline{\nabla} + \underline{\omega})\phi. \quad - (2)$$

Here ϕ is the scalar potential in volts, $\underline{\omega}$ is the vector spin connection, $\underline{E}$ is the electric field strength in volts / m, ρ is the charge density in $C m^{-3}$, ϵ_0 is the SI vacuum permittivity:

$$\epsilon_0 = 8.854 \times 10^{-12} J^{-1} C^2 m^{-1}. \quad - (3)$$

Thus:

$$\underline{\nabla} \cdot (\underline{\nabla} + \underline{\omega})\phi = -\rho / \epsilon_0 \quad - (4)$$

i.e.

$$\nabla^2 \phi + \underline{\nabla} \cdot (\phi \underline{\omega}) = -\rho / \epsilon_0. \quad - (5)$$

If $\underline{\omega} = \underline{0}$, eq. (5) reduces to Poisson's equation. Otherwise:

$$\nabla^2 \phi + \underline{\omega} \cdot \underline{\nabla} \phi + (\underline{\nabla} \cdot \underline{\omega})\phi = -\rho / \epsilon_0 \quad - (6)$$

In one (Z) dimension:

$$\frac{\partial^2 \phi}{\partial Z^2} + \omega_Z \frac{\partial \phi}{\partial Z} + \left(\frac{\partial \omega_Z}{\partial Z}\right)\phi = -\rho / \epsilon_0 \quad - (7)$$

2)

From consideration of the Coulomb Law off resonance the spin connection needed to reproduce experimental data is:

$$\omega_Z = \frac{1}{Z}. \quad -(8)$$

Therefore:

$$\frac{\partial \omega_Z}{\partial Z} = -\frac{1}{Z^2}. \quad -(9)$$

So eq. (7) becomes:

$$\boxed{\frac{\partial^2 \phi}{\partial Z^2} + \frac{1}{Z}\frac{\partial \phi}{\partial Z} - \frac{1}{Z^2}\phi = -\frac{\rho}{\epsilon_0}} \quad -(10)$$

Now assume that:

$$\rho = \rho(0)\cos(\kappa Z) \quad -(11)$$

so that the charge density is oscillating at wavenumber κ. Thus:

$$\frac{\partial^2 \phi}{\partial Z^2} + \frac{1}{Z}\frac{\partial \phi}{\partial Z} - \frac{1}{Z^2}\phi = -\frac{\rho(0)}{\epsilon_0}\cos(\kappa Z) \quad -(12)$$

If ϕ depends only on Z the partial derivatives can be replaced by total derivatives:

$$\frac{d^2 \phi}{dZ^2} + \frac{1}{Z}\frac{d\phi}{dZ} - \frac{1}{Z^2}\phi = -\frac{\rho(0)}{\epsilon_0}\cos(\kappa Z)$$

3) Now use a change of variable (Euler method) to reduce eq. (13) to a resonance equation. The needed change of variable is:

$$Z = \frac{1}{\kappa} e^{i\kappa x} \quad - (14)$$

Thus:

$$\frac{dx}{dZ} = \frac{1}{i\kappa Z} = -\frac{i}{\kappa Z} . \quad - (15)$$

Now use:

$$\frac{d\phi}{dZ} = \frac{d\phi}{dx}\frac{dx}{dZ} \quad - (16)$$

i.e.

$$\frac{d\phi}{dZ} = -\frac{i}{\kappa Z}\frac{d\phi}{dx} . \quad - (17)$$

The second derivative is:

$$\frac{d^2\phi}{dZ^2} = \frac{d}{dZ}\left(\frac{d\phi}{dZ}\right) = -i\frac{d}{dZ}\left(\frac{1}{\kappa Z}\frac{d\phi}{dx}\right) \quad - (18)$$

i.e.:

$$\frac{d^2\phi}{dZ^2} = \frac{i}{\kappa Z^2}\frac{d\phi}{dx} - \frac{i}{\kappa Z}\frac{d}{dZ}\left(\frac{d\phi}{dx}\right) \quad - (19)$$

Now use:

$$\frac{d}{dZ}\left(\frac{d\phi}{dx}\right) = \frac{d^2\phi}{dZ\,dx} = \frac{d^2\phi}{dx\,dZ} = \frac{d}{dx}\left(\frac{d\phi}{dZ}\right) \quad - (20)$$

from isotropy of space.

4) Thus:

$$\frac{d^2\phi}{dZ^2} = \frac{i}{\kappa Z^2}\frac{d\phi}{dx} - \frac{i}{\kappa Z}\frac{d}{dx}\left(\frac{d\phi}{dZ}\right)$$

$$= \frac{i}{\kappa Z^2}\frac{d\phi}{dx} - \frac{1}{\kappa^2 Z^2}\frac{d^2\phi}{dx^2} \quad -(21)$$

using eqs (17) and (20) in eq. (21).

Thus:

$$Z\frac{d\phi}{dZ} = -\frac{i}{\kappa}\frac{d\phi}{dx} \quad -(22)$$

$$Z^2\frac{d^2\phi}{dZ^2} = \frac{i}{\kappa}\frac{d\phi}{dx} - \frac{1}{\kappa^2}\frac{d^2\phi}{dx^2} \quad -(23)$$

Now substitute eqs. (22) and (23) in eq (13), which is:

$$Z^2\frac{d^2\phi}{dZ^2} + Z\frac{d\phi}{dZ} - \phi = -\frac{\rho(0)}{\epsilon_0}Z^2\cos(\kappa Z) \quad -(24)$$

Thus:

$$\frac{i}{\kappa}\frac{d\phi}{dx} - \frac{1}{\kappa^2}\frac{d^2\phi}{dx^2} - \frac{i}{\kappa}\frac{d\phi}{dx} - \phi = -\frac{\rho(0)}{\epsilon_0}\frac{1}{\kappa^2}e^{2i\kappa x}\cos\left(e^{i\kappa x}\right) \quad -(25)$$

5)

Thus:

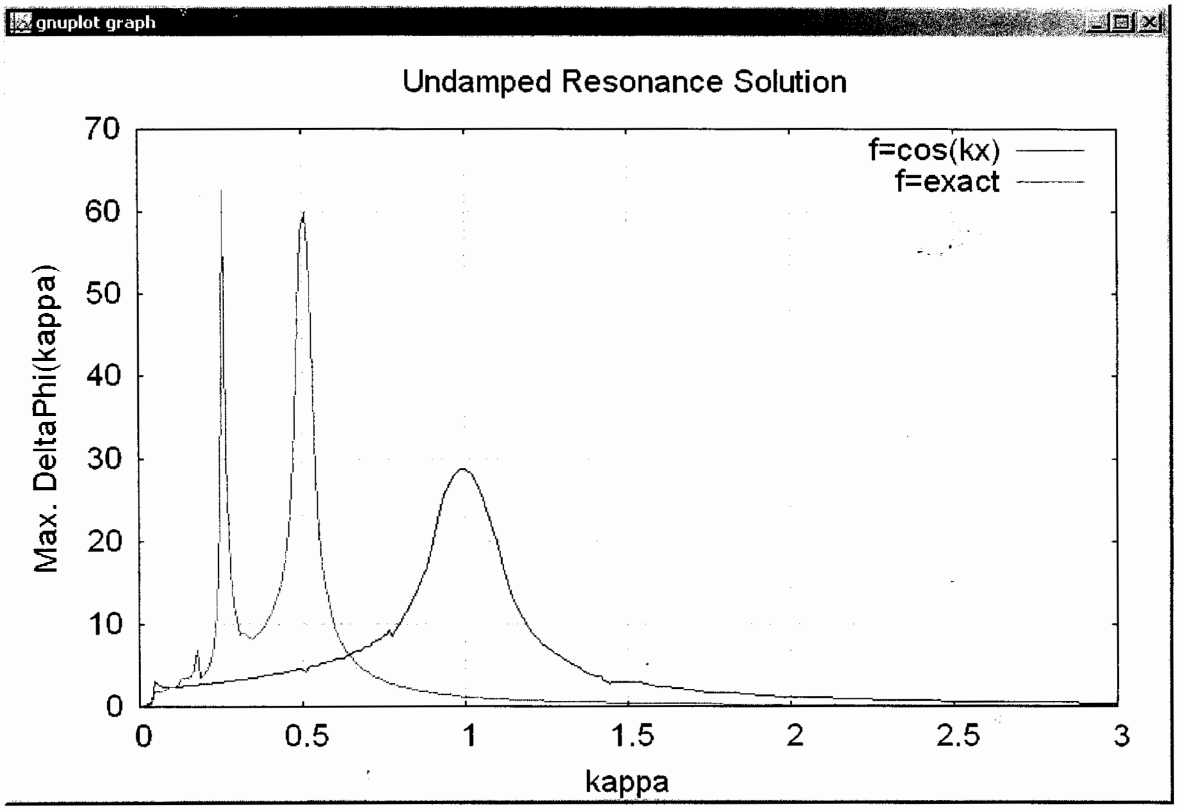
$$\frac{d^2\phi}{dx^2} + \kappa^2\phi = \frac{\rho(0)}{\epsilon_0}\,\mathrm{Real}\left(e^{2i\kappa x}\cos\left(e^{i\kappa x}\right)\right)$$

$$= \frac{\rho(0)}{\epsilon_0}\Big(\cos(2\kappa x)\cos(\cos(\kappa x))\cosh(\sin(\kappa x))$$

$$+ \sin(2\kappa x)\sin(\cos(\kappa x))\sinh(\sin(\kappa x))\Big) \quad -(26)$$

This is an undamped resonator equation. The driving term is given on the right hand side and the Hooke term is $\kappa^2\phi$.

The resonances from eq. (26) have been worked out numerically by Dr. Horst Eckardt and are given in Fig (1). The tuning parameter is κ. At resonance the voltage ϕ is greatly amplified, as seen experimentally in the work of several groups and inventors.



The first space-time spectrum, 25th June 2006

One electron, one dimensional oscillator.

Fig (1)