October 10, 2007

PHY 711 – Problem Set # 14

Start reading Chapter 7 in **Fetter and Walecka**.

1. Suppose that you have a very long uniform wire stretched along the x-axis with constant tension. To a very good approximation, transverse waves are described by vertical displacements (with respect to equilibrium) by a function $f(x,t)$ which satisfies a wave equation

$$\frac{\partial^2 f}{\partial t^2} = c^2 \frac{\partial^2 f}{\partial x^2}. \tag{1}$$

In this equation, c represents a known constant which depends on the tension and the mass per unit length of the wire. Also suppose that the following initial value information is known:

$$f(x,t)\rfloor_{t=0} = 0. \tag{2}$$

$$\left.\frac{\partial f(x,t)}{\partial t}\right|_{t=0} = -\frac{\sinh(x)}{\cosh^2(x)}. \tag{3}$$

   (a) Use Maple or other software to plot $f(x,t)\rfloor_{t=0}$ and $\left.\dfrac{\partial f(x,t)}{\partial t}\right|_{t=0}$.

   (b) Find the analytic form of $f(x,t)$ for some $t > 0$.

   (c) Use Maple or other software to plot $f(x,t)$ and $\dfrac{\partial f(x,t)}{\partial t}$ for at least two values of $t > 0$.