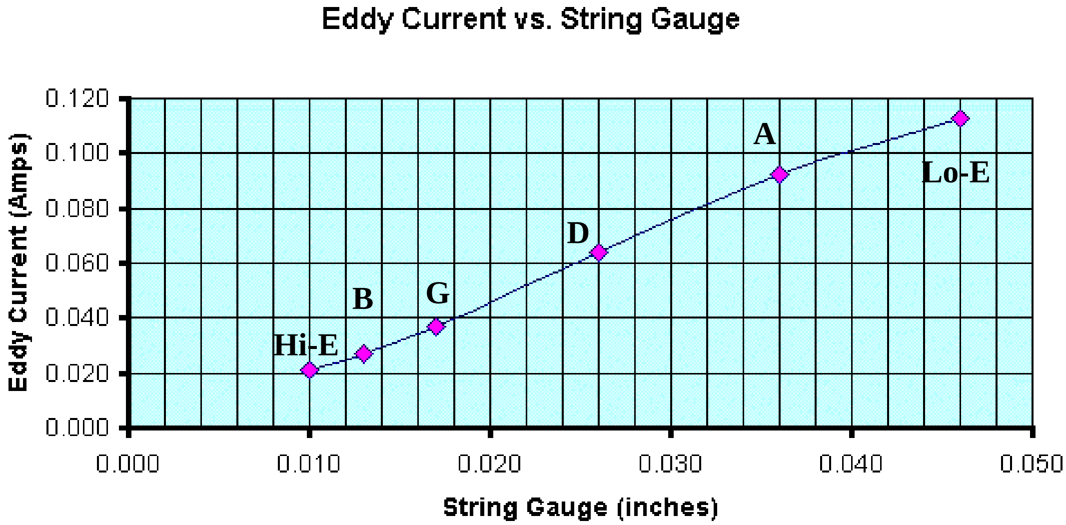

It can be seen that the magnitude of the Eddy current induced in the strings of an electric guitar ranges from I_{Eddy} ~ 20 mA for the high-E string to I_{Eddy} ~ 115 mA for the low-E string. The increase in I_{Eddy} with string gauge is due to the cross sectional area term, $A_{string} = \pi r^2_{string}$ term, which is quadratic in the string gauge (= string diameter). However, I_{Eddy} also depends linearly on the string vibration frequency, f; thus the induced Eddy current in each of the strings is ~ linear with string gauge.

As a consequence of creating an induced time-dependent current, I_{Eddy} (t) flowing in the string, a time-dependent EMF (i.e. a voltage, or potential difference), ε(t) (units: volts) is also induced across the ends of the string, which is given by:

$$\varepsilon(x,y,z,t) = \int_{x=0}^{x=L} |E(x,y,x,t)|\,dx = \frac{1}{q}\int_{x=0}^{x=L} |F(x,y,x,t)|\,dx$$
$$= \int_{x=0}^{x=L} |u_y(x,t)||B(x,y,z=h)|\sin\varphi dx$$

where $|u_y(x, t)|$ is the magnitude of the transverse velocity of the string at the point, x at time, t, and |B(x)| is the magnitude of the magnetic field intensity at the point, x on the string and sinφ is the opening angle between the plane of the transversely vibrating string and the direction of the magnetic field intensity, B(x) of the permanent magnet at the point, x on the string. Because the magnetic field intensity decreases so rapidly in moving away in any direction from the immediate vicinity of the pole of the permanent magnet of the pickup, located directly underneath the guitar string, the bulk of the contribution of the *integrand*, $|u_y(x,t)||B(x)|\sin\varphi dx$ of the above integral occurs in the x-region of the string in the vicinity of the pole of the permanent magnet.

Since the permanent magnets of a e.g. a single-coil guitar pickup typically have a diameter, D ~ 5 mm = 0.005 m = 5×10^{-3} m, the time-dependent EMF, ε(t) induced across the ends of the vibrating string is approximately $\varepsilon(t) \cong |u_y(x_{pu}, t)||B(z=h)|D$, for strings vibrating parallel to the plane of the guitar body. If the typical transverse displacement, y(x, t) of a guitar string has an