

Fields and Waves I – Fall 2000
Project 2 – Report Due November 27, 2000

Eddy Current Nondestructive Crack Detector

A common method to find flaws and small cracks or dents in a good conductor is by nondestructive eddy current testing. Nondestructive means simply that we do not need to remove a sample or break the piece in order to find the defect. If we apply a time varying field to the conductor we will induce eddy currents which produce a reaction field

(Lenz's law). Recall that the skin effect $d = \sqrt{\frac{2}{\omega \mu \sigma}}$ determines the depth to which the

eddy current penetrates and can be varied to find cracks near the surface or deeper into the metal. If we apply the field by means of a small coil which we slide along the surface, then the inductance of the coil will be different if pass over a crack or a hole. The coil current will change. We can also use a second open circuited coil around or near the first coil and find the change in mutual inductance as we pass over the flaw. There is a lot of literature on these devices which you can use.

Construct an eddy current detector. You do not have to use the model below and as always originality is a good thing. You should estimate the impedance of the coils with and without the large conducting surface. The method of images might be a good way of estimating the inductance with the conductor. Use the inductance meter in the studio to check your results. You will be able to demonstrate the device in class. We will provide an aluminum plate (about 1 cm thick) with holes and dents in it. Think about what frequency or frequencies you should use. Is a square wave better than a sine wave?

