The possibility of using metamaterials in nondestructive evaluation by electromagnetic methods

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Using the idea that metamaterials can serve as concentrator of high frequency magnetic flux, a new type of microstructured electromagnetic material that has strong magnetic properties near the resonance, in the radio frequency band, has been conceived and developed. We have used the material to guide RF flux from the emission coil to material and from material at reception coil in eddy current examination. The prototype material has provided a significant improvement in the spatial resolution of a “classical” send receiver eddy current transducer; improved materials are likely to have a major impact on eddy current examination.

$$L_s = \frac{\mu_0 \pi r^2 (N-1)^2}{2\pi r}$$

$$C_s = \frac{\varepsilon_r \varepsilon_0}{d(N-1)}$$

$$R_p = \frac{d(N-1)}{2\pi r}$$

$$\omega_0 = \frac{1}{\sqrt{L_s C_s}}$$

$$Q = \frac{\omega_0}{\frac{R_p}{\omega_0 L_s}}$$

Partitioning of conical Swiss roll into a succession of short length cylindrical Swiss rolls.

S parameters vs frequency:

**Experimental set-up**

Real component of emf induced in the reception coil for 190MHz frequency

The real component of emf induced in the reception coil at 190MHz frequency using conical Swiss rolls as flux concentrator

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