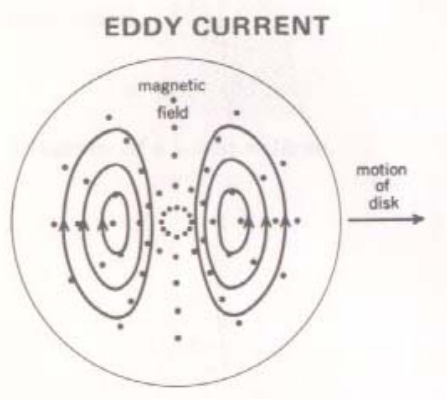
Application Note

1920 Used in Eddy Current Sensor Testing

The IET Labs. 1920 LCR Meter is used in a customer's test system for the measurement and analysis of the electrical conductivity of eddy current sensors. The CONDUCSENS™ system from Sciensoria http://www.sciensoria.fr/SCIENCES.HTM consists of a high precision/high sensitivity eddy current sensor, a 1920 precision LCR meter and Windows™ based computation software. The 1920 instrument is used to measure the magnetic field generated by the sensor and interpolate results to measure the thickness of the aluminum layer in order to analyze the electrical conductivity of the sensor (plate).

An eddy current is a current induced in the body of a conductor when the conductor moves through a non-uniform magnetic field or is in a region where there is a change in magnetic flux. The energy loss due to unwanted eddy currents circulating in a magnetic core is termed eddy-current loss. The eddy-current test is a non-destructive test. A test coil is brought in close proximity to a conducting specimen. The impedance of the test coil is measured and any change indicates eddy currents induced by the coil. This change and presence of eddy currents indicates specific properties and defects of the specimen. Therefore an eddy current sensor is a very necessary tool in characterizing electro-magnetic components.



A transformer is an efficient energy-transferring device but the transfer of energy from the primary circuit to the secondary circuit occurs with some loss. Copper loss and eddy current loss are wasted energy and processed as heat (I^2R) losses. Eddy current losses in motor and generator armatures and transformers are induced currents that oppose the change that induces them. To reduce eddy current loss, the armatures and cores are laminated with thin sheets of metal with insulated surfaces. The laminations are placed parallel to the magnetic flux so that the eddy current loops are confined to the width of the individual laminations. The high resistance of the narrow width of the individual laminations, effectively, reduces the induced currents and the I^2R heat losses.

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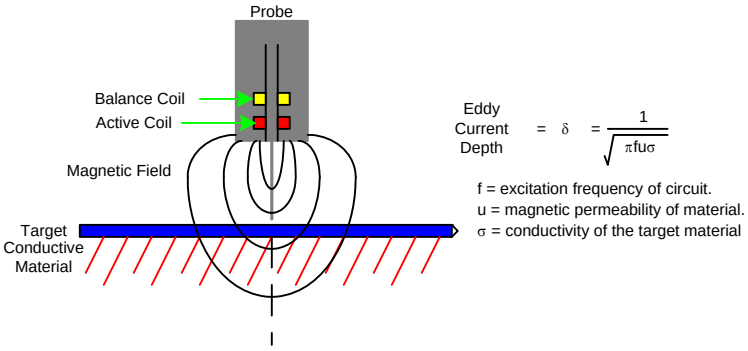
The 1920's role



The test system places an exciting coil that generates a high frequency magnetic field close to (but not touching) the target specimen to create the eddy currents. These induced currents produce a secondary magnetic field. Measuring the resulting field composed of the primary and secondary fields, the sensor receives the target specimen characteristics: electrical conductivity, thickness, shape and the sensor-target distance ("lift-off"). This sensor can be used for conductivity measurements of thin or finite thickness targets, targets covered with a layer of material of variable thickness and on materials of low electrical conductivity. All conductive materials (metals, graphite and composites) can be measured with this test system. Specimen targets must be flat and the smallest dimension of which must be greater than or equal to 3 times the sensor diameter.

The 1920 instrument provides the test system with the ability to measure the secondary parameter conductance (G) from 10nS to 9999.9 S over a programmable frequency range of 20Hz to 1MHz. Measure and display of 15 impedance parameters plus DC resistance measurement and DUT voltage and current measurements are possible. The standard 1920 instrument is equipped with IEEE-488, RS232 and Handler interfaces for data logging and automated testing.

DISCLAIMER

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