



TECHNOLOGY NOTE

M12 PORTABLE LOW- μ PERMEAMETER

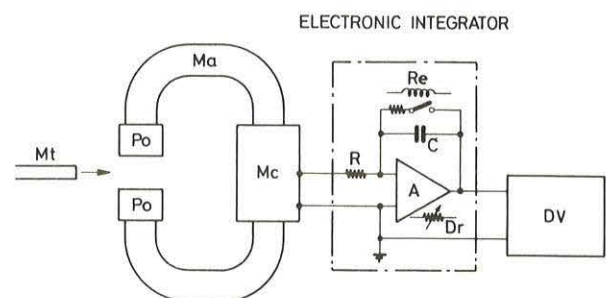
This small portable instrument provides a direct measurement of the magnetic susceptibility $\kappa = \mu_r - 1$ (μ_r being the relative magnetic permeability) in the range of $\kappa = 0.0001$ to $\kappa = 0.2$. The precision is of the order of 1% of the reading and it can be equipped with a large variety of probes which are designed for any specific task (measurement on blocks, sheets, bars, etc.) and for field levels up to 1 Tesla.

Use in the ISR

The device was specially developed to measure the skin susceptibility of the austenitic manganese stainless steel support pillars for the SFM. Three probes were made for fields of respectively 0.24, 0.31 and 0.40 Tesla.

Description

Ma = permanent magnet
Po = soft iron pole pieces
Mc = measuring coil
Mt = material to be tested
Re = integration reset relay
A = amplifier
Dr = drift adjustment
DV = digital voltmeter



The set-up is original in that a small permanent magnet is used to produce the required field level. When a piece of material of magnetic susceptibility $\kappa \ll 1$ is brought into the gap, the magnetic flux in the coil varies by a small amount proportional to $\kappa(1-\kappa)$. The signal induced into the coil is fed via an electronic integrator to a digital voltmeter calibrated directly in values of $\kappa(1-\kappa)$.

Technical problems

The main difficulties encountered in the development of this device resulted from the weakness of the signals. Low-noise chopper amplifier was selected for the integrator and measuring coils of typically 12000 turns were wound with 0.05 mm diameter enamelled copper wire. The calibration of the instrument was made by comparison with another method based on the measurement of the force exerted on a small sample in a non-uniform field.

Reference

"A portable device to measure low magnetic permeability in situ" by J.P. Gourber, Proc. 4th Int. Conf. on Magnet Technology, Brookhaven, 1972.

8th March 1974