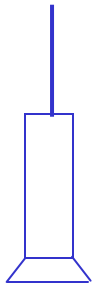
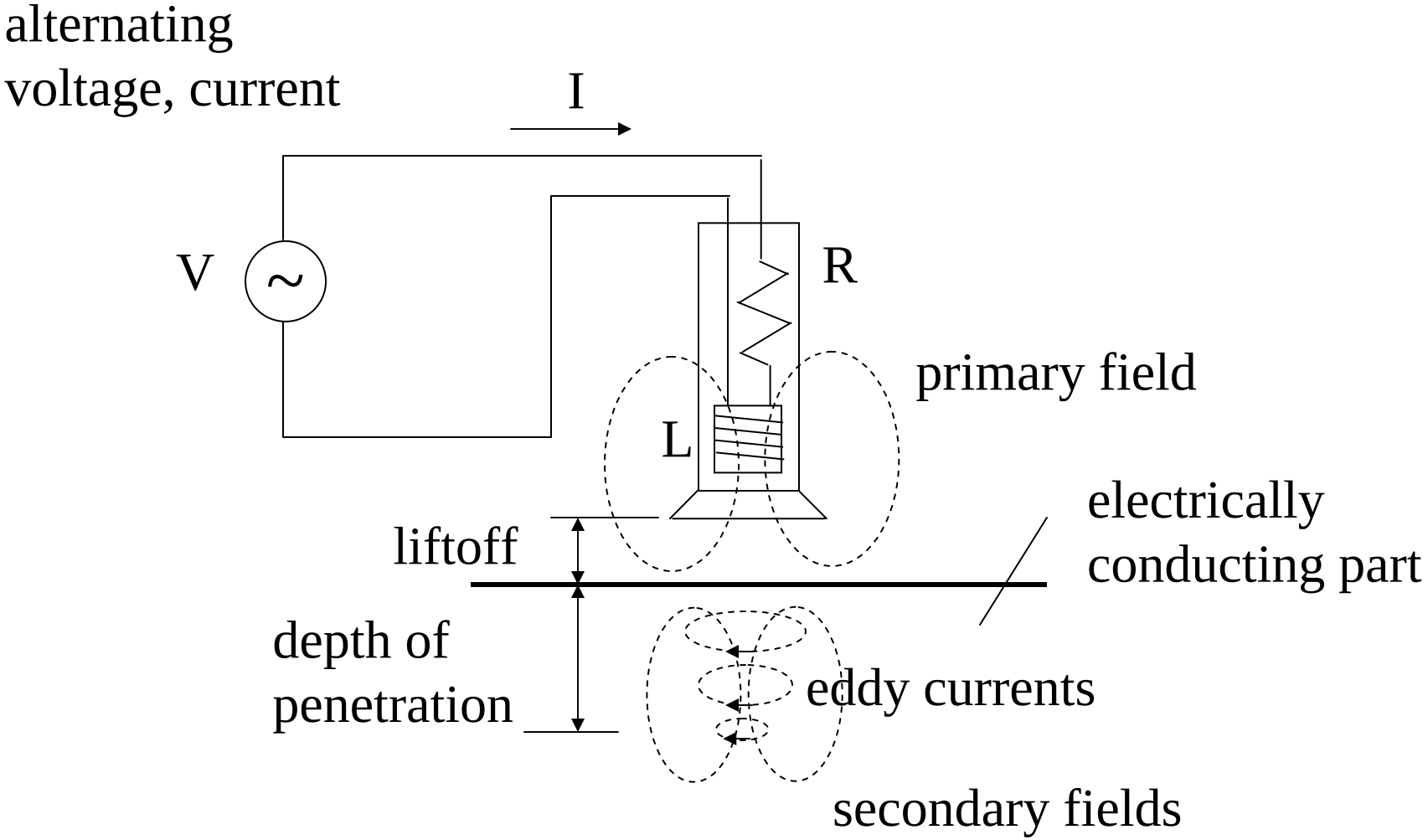


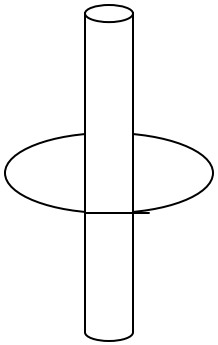
Introduction to NDE Eddy Current Systems

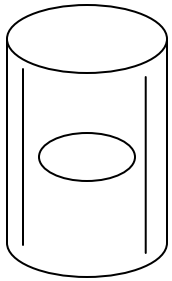
Basic Eddy Current Setup



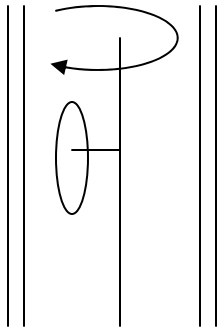
Hand-held Eddy Current Probes

Tubing Probes





Motorized Pancake Coils



Some characteristics of eddy current testing

non-contacting

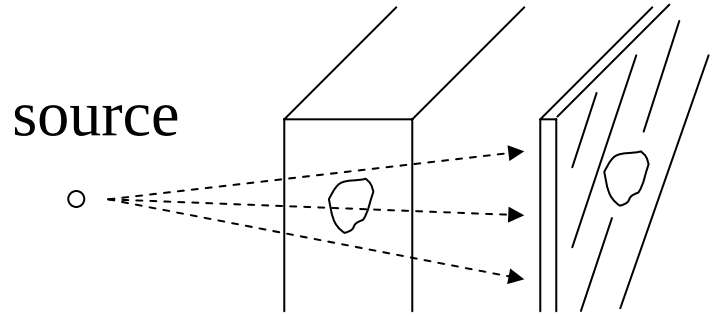
single-sided access

material must be an electrical conductor

depth of penetration limited by frequency

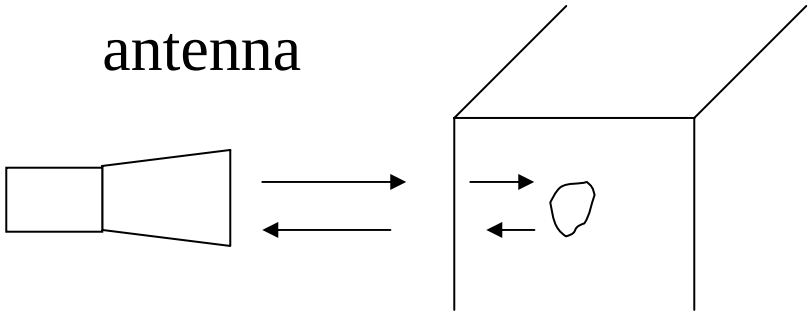
liftoff variations and edge effects must be compensated for

X-rays



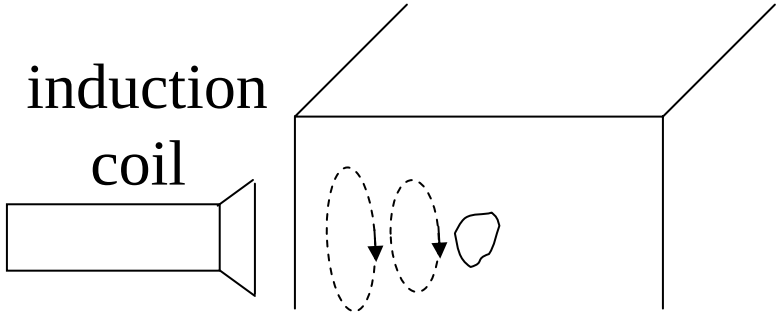
$f = 10^{17} + Hz$

Microwaves



$f = 10^{9} - 10^{11}$ Hz

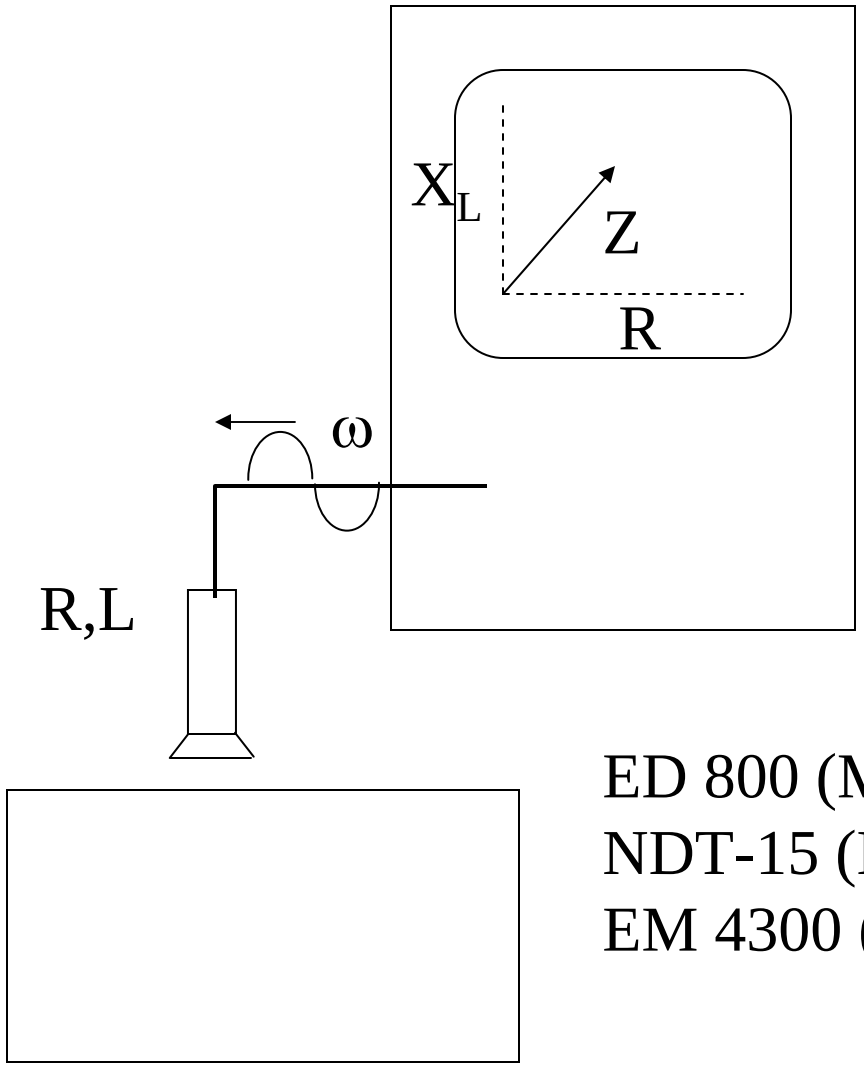
Eddy Currents



$f = 100 - 10^{7}$ Hz

All these methods use a time varying electromagnetic field but because they operate at drastically different frequencies the physics of the interactions is different for each method.

Eddyscope



R … resistance

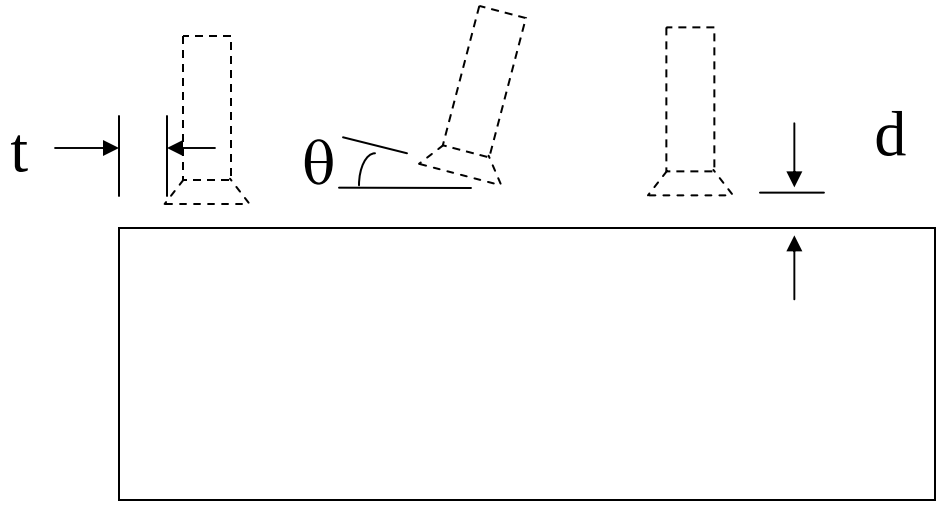
$X_L = \omega L$… inductive reactance

$Z = R + i\, X_L$

complex impedance

ED 800 (Magnaflux)	100 Hz - 2.5 MHz
NDT-15 (Nortec)	100Hz - 5 MHz
EM 4300 (Zetec)	100 Hz - 6 MHz

Eddyscope Zetec Miz-27 ET

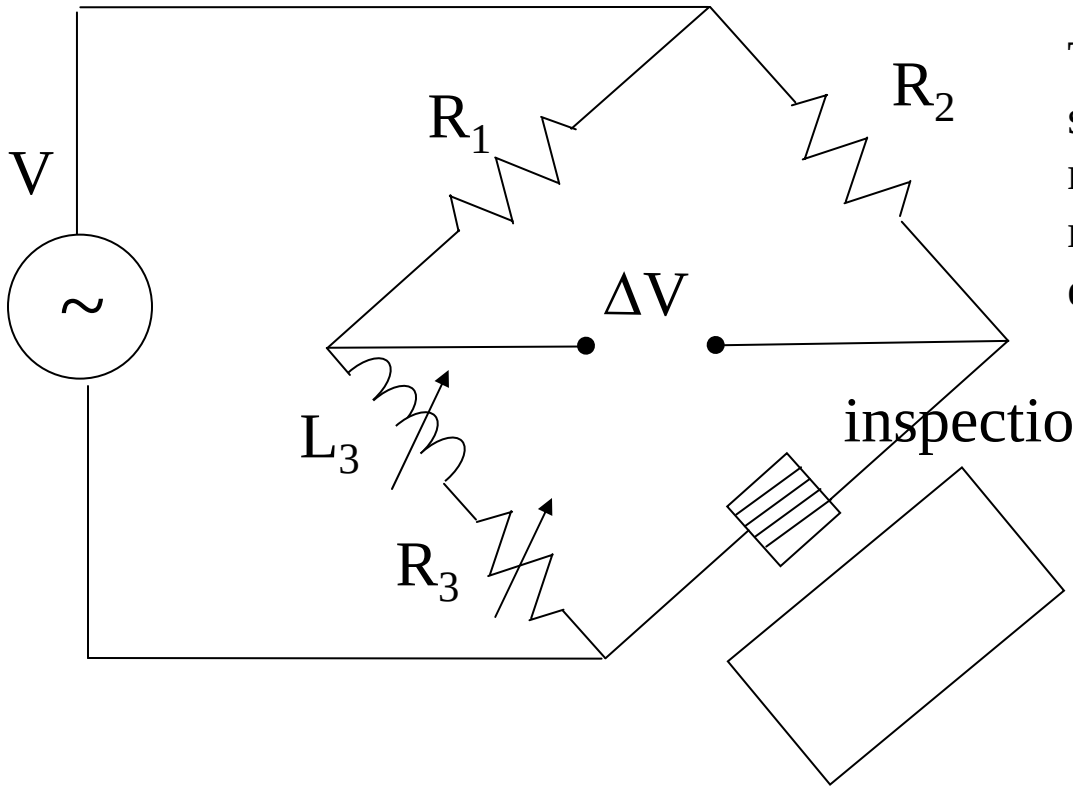


Variations in liftoff (d), tilt (θ) and geometry changes (edge effects, etc.) can produce significant changes in the measured complex impedance. Thus, these unwanted competing effects must either be compensated for or controlled.

$|Z|_{probe} \sim 100$ ohms $\qquad$ $|\Delta Z|_{flaw} \sim 1/10$ ohm

$\Rightarrow$ need a bridge to measure these small impedance changes

Eddy scopes contain bridges such a Maxwell's inductance bridge:



The bridge can be adjusted so that $\Delta V \propto \Delta Z$. Both resistance and inductive reactance changes can be displayed

inspection coil $Z_4 = R_4 + i\,\omega L_4$

test part