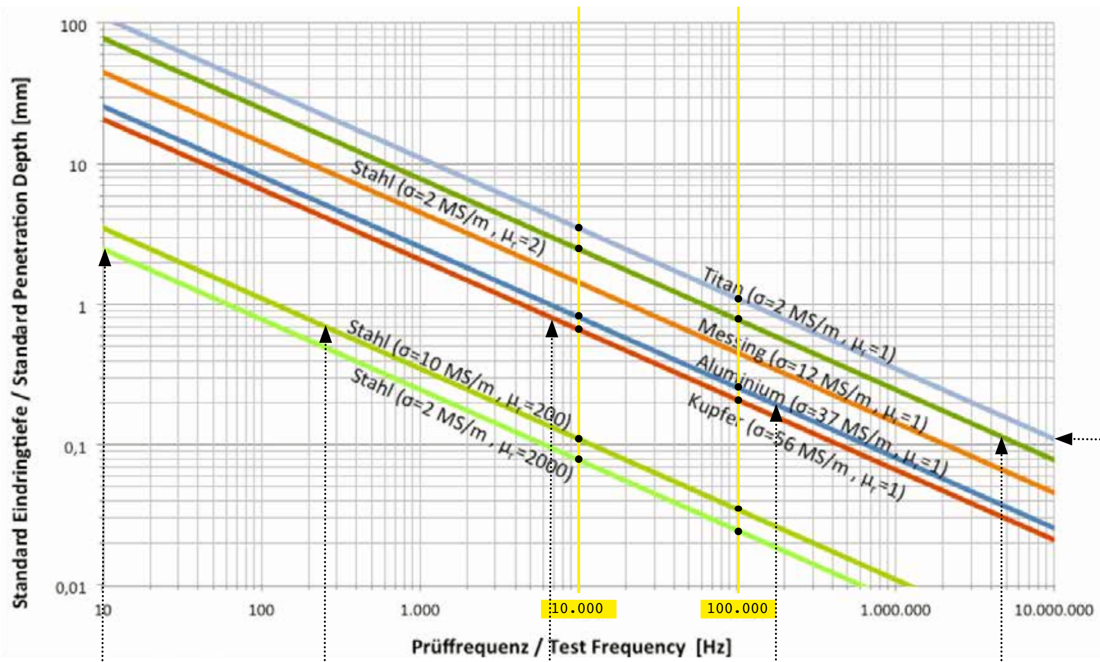
Frequency selection for eddy current testing

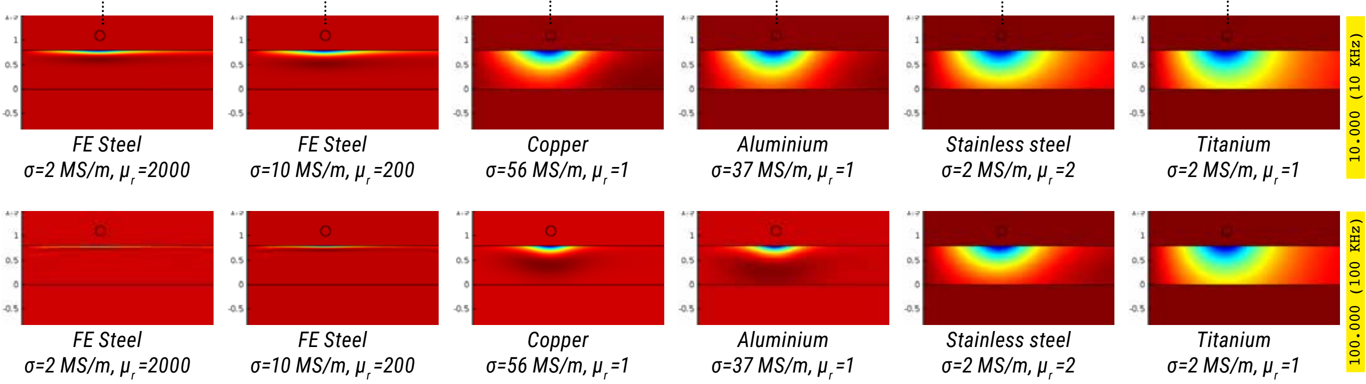
Standard Penetration depth in mm

$$\delta = \frac{500}{\sqrt{\sigma \cdot \mu_r \cdot f}}$$

In principle, eddy current testing is to be classified as a surface testing method. Depending on the method, the induced eddy currents are concentrated on a more or less thin layer near the surface. The strongest eddy currents flow directly at the surface. Therefore, the maximum test sensitivity can be achieved there. The decrease in eddy current intensity with increasing depth (distance from the surface) is caused by the shielding effect of flowing eddy currents ("skin effect"). In eddy current testing, the so-called standard penetration depth is usually used as a measure of the depth-dependent decrease in eddy current intensity. The greater the electrical conductivity or relative permeability or the higher the test frequency, the more the eddy currents are concentrated on the surface of the test object and the smaller the standard penetration depth.
On the basis of the standard penetration depth, the depth detection capability can thus be roughly estimated, taking into account the existing test conditions (material properties and test frequency).



Standard penetration depth of the different materials depending on the frequency.



Eddy Current Test Instruments and Systems

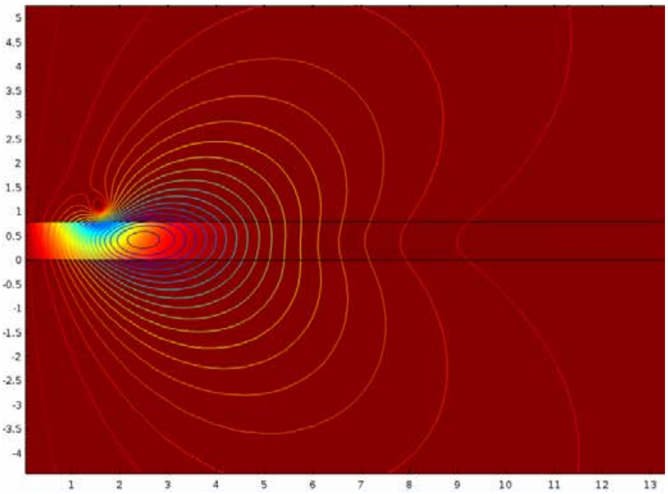
Rohmann GmbH

Multiphysics simulation of eddy currents inside titanium

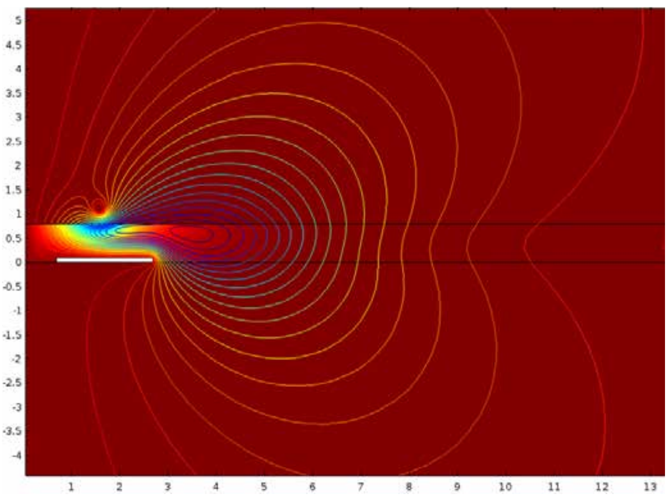
These simulation results let us understand the effect of the interaction of surfaceinduced current density distribution (eddy currents) with subsurface defects at 300 kHz and 3 MHz. The lower the frequency, the higher is the interaction and the higher is the probability of detecting the defect. The higher the frequency, the lower is the penetration depth and the lower is the interaction of eddy currents with these subsurface defects (making detection difficult).
A considerable amount of research and development is involved in the manufacture of Rohmann's Eddy current sensors.

300 kHz

freq(1)=300 kHz Surface: Induced current density, phi-component (A/m^2) Contour: Aphi*r (Wb)

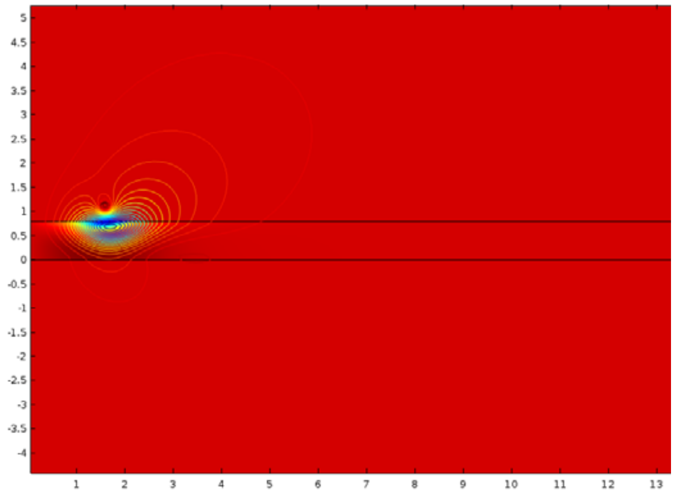


freq(1)=300 kHz Surface: Induced current density, phi-component (A/m^2) Contour: Aphi*r (Wb)

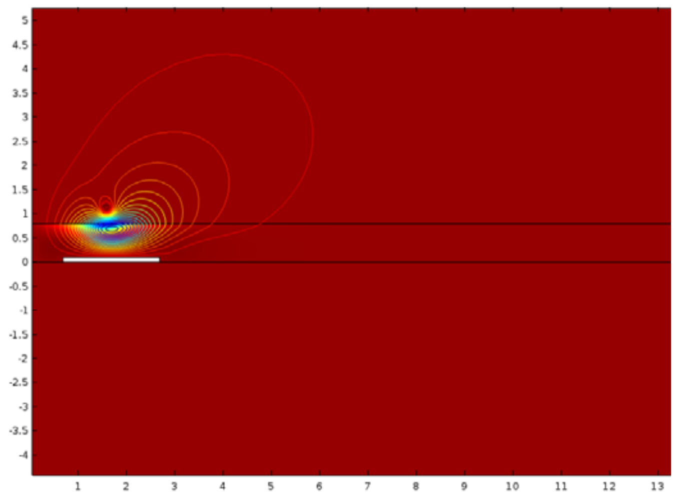


3 MHz

freq(1)=3 MHz Surface: Induced current density, phi-component (A/m^2) Contour: Aphi*r (Wb)



freq(1)=3 MHz Surface: Induced current density, phi-component (A/m^2) Contour: Aphi*r (Wb)



ELOTEST PL600 test instrument

Application: Eddy current test instrument for the inspection during production; fastest material sorting and high-resolution crack detection; extremely fast due to 100 kHz bandwidth for the test signal; extremely low-noise and stable due to fully digitized signal processing; extremely flexible for up to 256 test channels. Frequency range: 10 Hz – 12 MHz

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