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Measurements on Accelerometers Coils

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Change Record

<i>Issue</i>	<i>Date</i>	<i>Affected Paragraphs</i>	<i>Reason/Remarks</i>	<i>Author</i>
1.0	23/02/2012	All	First release	N. Grilli

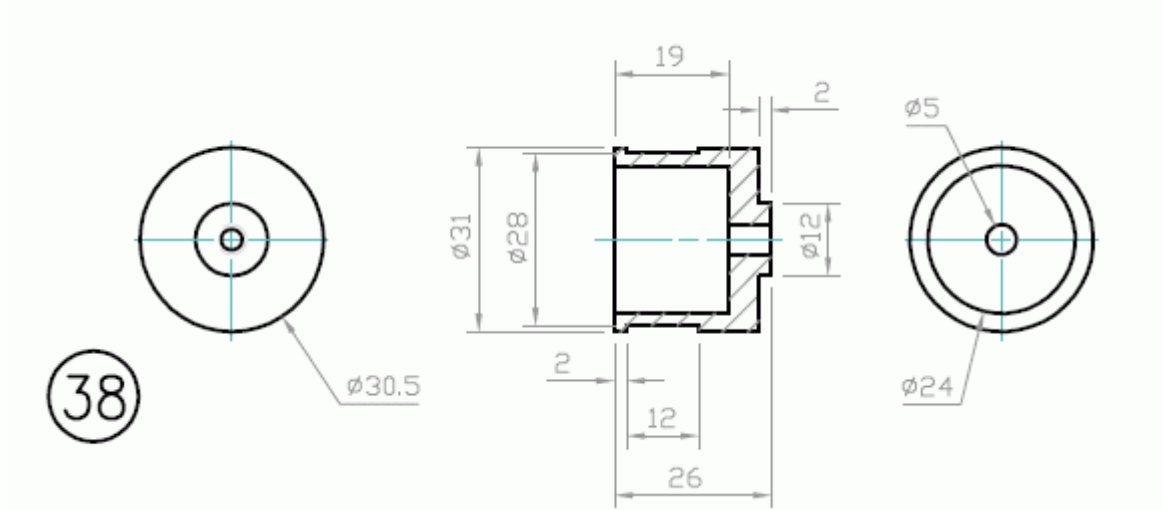
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1. Measurements on Accelerometers Coils (50 KHz)

Feedback (with the magnet)

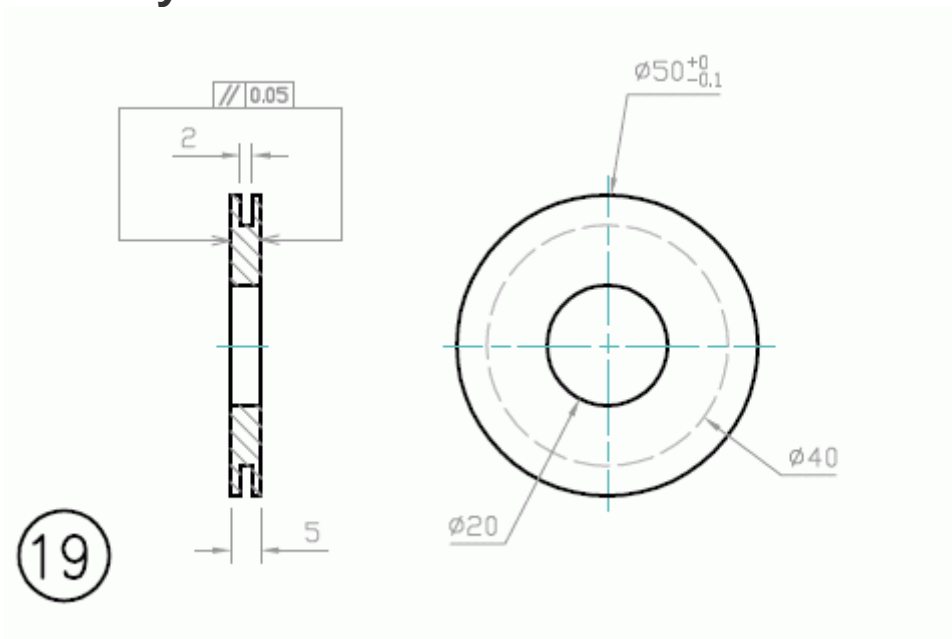


Measured values:

$R = 3.2 \text{ K}\Omega$

$L = 0.11 \text{ H}$

Primary coil



Nominal values

Wire: AWG 28; diameter = 0.321 mm (resistance = 0.213 Ohm/meter)



$N = 45-50$ windings

Measured values on a coil:

$R = 2.1$ Ohm

$L = 0.13$ mH

Wire diameter = 0.36 mm

Theoretical values:

COMSOL calculation of L :

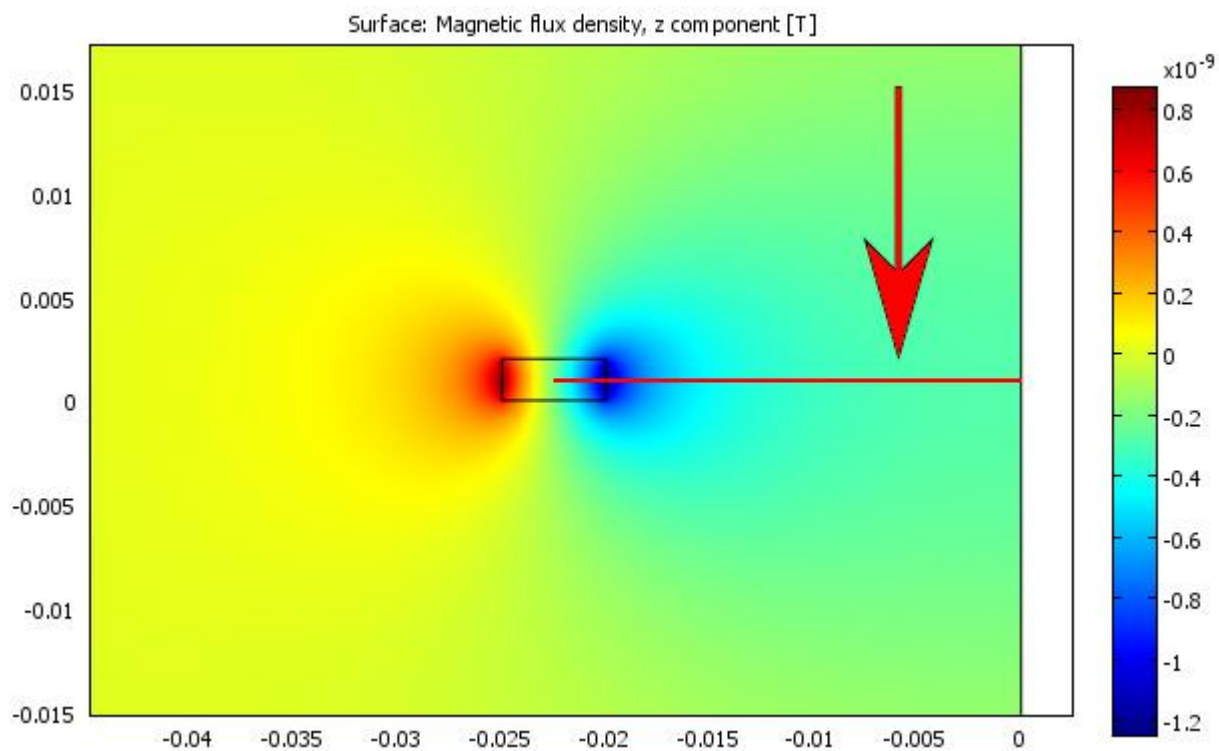


Fig 1: axial component of the magnetic field (axial simmetry)

Flux Φ_1 on a single winding calculated on the red line in Fig. 1;

current density J fixed in the calculation ;

$N =$ number of windings

$A =$ total area of the coil = $1 \cdot 10^{-5} m^2$

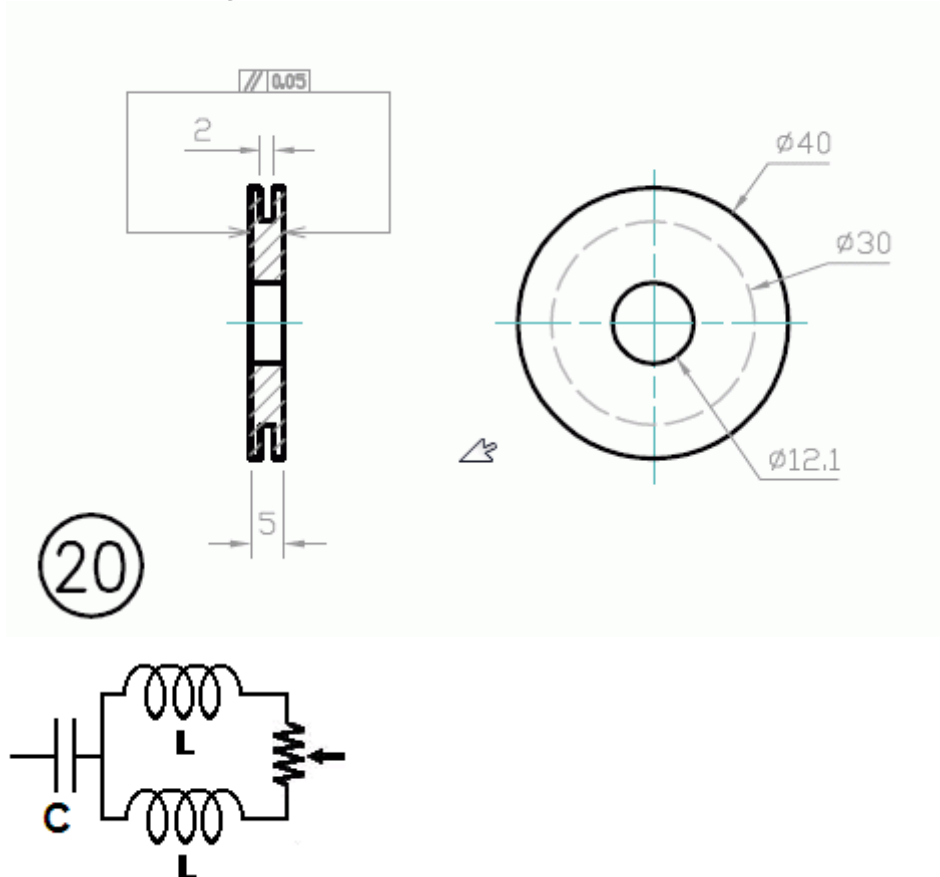
$$L = N^2 \frac{\Phi_1}{JA} \Rightarrow N = 46 ;$$



$$N = 46 \Rightarrow R = 1.3 \Omega$$

Skin effect negligible at 50 KHz

Secondary coil



Nominal values

Wire: AWG 40 diameter = 0.08 mm (resistance = 3.44 Ohm/meter)

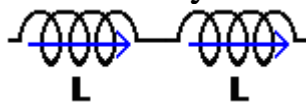
N = 450 – 500 windings

Measured values on a coil:

R (1 coil) = 210 Ohm

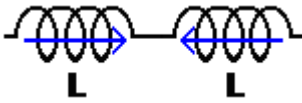
M = mutual inductance

2 secondary coils connected so that they produce parallel magnetic fields:



Total inductance: $L_{TOT-parallel} = 27 \text{ mH}$

2 secondary coils connected so that they produce opposite magnetic fields:



Total inductance: $L_{TOT-opposite} = 22.5 \text{ mH}$

$$L_{TOT-parallel} = 2L + 2M$$

$$L_{TOT-opposite} = 2L - 2M$$

$$\Rightarrow L = 12.4 \text{ mH} \quad M = 1.1 \text{ mH}$$

Wire diameter = 0.08 mm

Other parameters:

R (trimmer) = 103 Ohm

C = 1.8 nF

Theoretical values:

COMSOL calculation of L (similar to Fig. 1):

$$L = N^2 \frac{\Phi_1}{JA} \Rightarrow N = 450$$

$$N = 450 \Rightarrow R = 159 \Omega$$

Skin effect negligible at 50 KHz