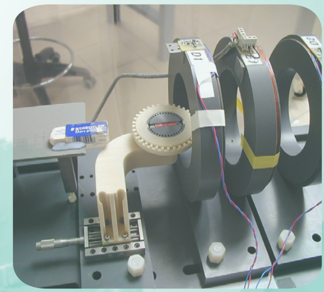


Magnetic Resonant Sensor

Principle

Magnetic resonant sensors (M.R.S.) are resonators whose resonant frequency can be driven, at distance, by a bias magnetic field. When excited at their resonant frequency, M.R.S. magnetic response can be detected and processed following the application (Fig. 1). To allow this frequency control, the non linear properties of magnetic materials, as function of static or quasi-static field, are used. One interesting physical property is the variation of incremental dynamic permeability versus the bias magnetic field (Fig. 2 & 3).

Typical characteristics of MRS and their performances in possible applications are given in the following table (Fig.10). This table is not exhaustive as MRS can be customized for many applications. In particular larger detection range are possible with larger MRS.

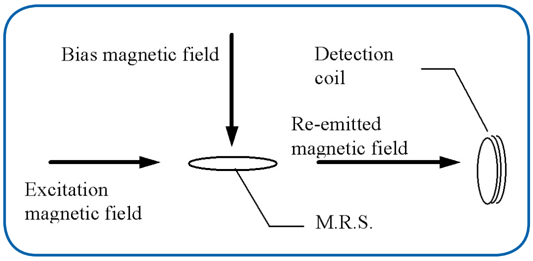


Figure1: Detection principle.

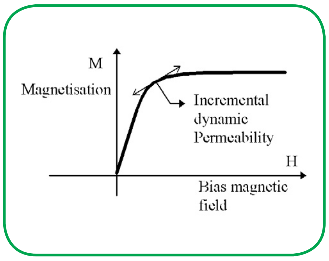


Figure 2: M(H) curve.

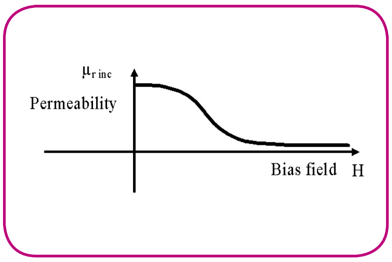


Figure 3: Dynamic permeability versus bias field.

This phenomenon is used in M.R.S. based on L.C. technology. These sensors are composed of a coil (L) with a capacitor (C) (Fig. 4 & 5). The coil core is made of saturable magnetic material. The value of self inductance changes with the bias magnetic field via the dynamic permeability, and induces a change of resonant frequency (Fig. 6).

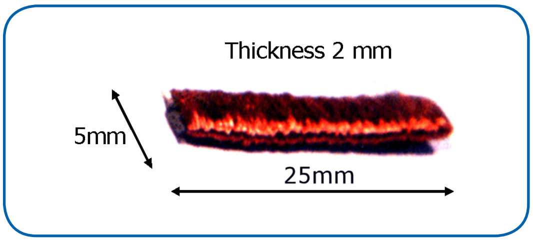


Figure 4: L.C. M.R.S.

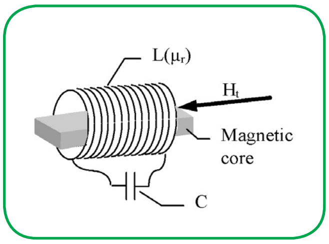


Figure 5: L.C. M.R.S.

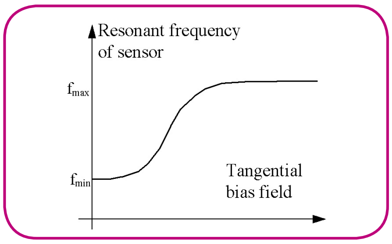


Figure 6: f(Ht) law of L.C. M.R.S.

The magneto-elastic resonators, especially magnetostrictive ribbons (Fig. 7) also present a resonant frequency depending on the bias field. This is due to the Young modulus of the material which depends on the bias and which control the stiffness. This variation of stiffness associated to the modal mass (Fig. 8) determines the change of resonant frequency (Fig. 9).

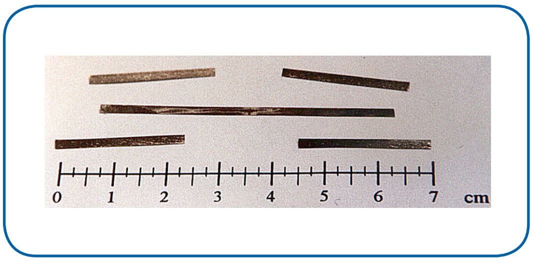


Figure 7: Magnetostrictive M.R.S.

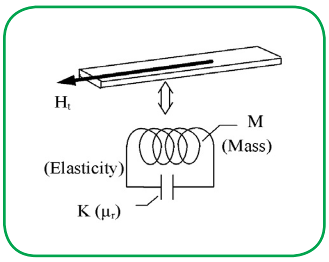


Figure 8: Magnetostrictive M.R.S.

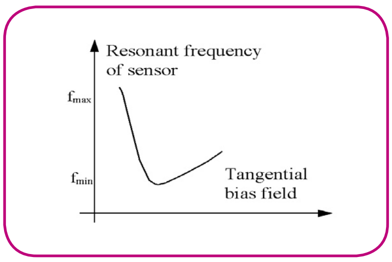
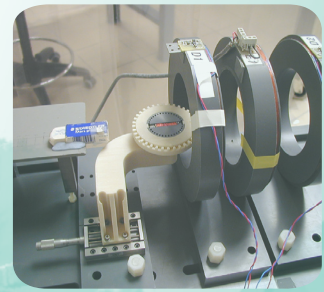


Figure 9: f(Ht) law of magnetostrictive M.R.S.



Magnetic Resonant Sensor

Performance

Typical characteristics of MRS and their performances in possible applications are given in the following table (Fig.10). This table is not exhaustive as MRS can be customized for many applications. In particular larger detection range are possible with larger MRS.

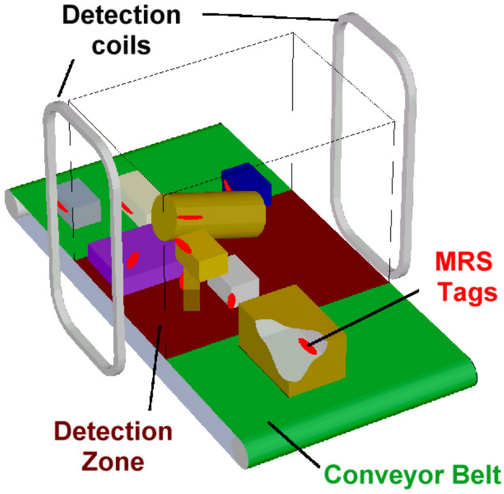
References	Unit	LC	Magnetostrictive Ribbon
Notes			
Resonnace principle		LC	Magnetostriction
Sensor length	mm	30	[20 to 60]
Sensor width	mm	5	2
Sensor thickness	µm	2000	35
Frequency without magnetic field	kHz	[20 to 200]	[10 to 70]
Frequency variation	%	29	33
Detection distance	mm	200	200
Max field sensibility	Hz/µT	223	440
Excitation AC field magnitude	A/m	units	units
Max DC field magnitude	A/m	100	100
Linear one axis consistency	mm	0,5	0,5
Anglar consistency	°	0,5	0,5
Coding range capability		1,00E+06	1,00E+06
Simultaneous number of object identified		10	10
Number of detection axis		1 to 3	1 to 3

Applications

Magnetic resonant sensors are remote passive magnetic field sensors (contactless) with an integrated antenna for data transfer. They can be used for contactless magnetic field measurement.

Associated with a controlled magnetic source they are used as contactless angular position sensor or as contactless linear position sensor.

A system association with computation means, MRS sensor can be used as ID tags for remote identification of objects. CEDRAT TECHNOLOGIES has a 10 years experience of this application.



GROUPE CEDRAT

www.cedrat.com

For more information, please contact:

CEDRAT TECHNOLOGIES
15 Chemin de Malacher - Inovallée
38246 Meylan Cedex - France
actuator@cedrat.com
Phone: +33 (0)4 76 90 50 45 - Fax: +33 (0)4 56 38 08 30