SYSTEMS DIVISION

MAGNETIC SENSORS

MAGNETO-RESISTIVE AND INDUCTIVE SENSORS

DESCRIPTION

Semelab has developed the capability to design and supply magnetic sensor components and modules. These devices are complementary to the range of optical sensors supplied by Semelab's Opto Division.

The sensor elements fall into two categories of magneto-resistive (MR) and inductive sensors. The magneto-resistive sensors can be further sub-divided into sensing element categories. Semiconductor magneto-resistive sensors are alloys of nickel and indium antimonide. The devices exhibit a change in resistance of up to 2% when exposed to an external magnetic field. The sensors are usually supplied in a differential configuration with integral bias, 2 magnetising magnet. Semiconductor magneto-resistive elements are ideally suited to measurements of magnetic field strength from 100nT up to 0.1T.

Simple ferromagnetic magneto-resistive sensors also exhibit a change in resistance of about 2% when exposed to an external magnetic field. The sensor elements are thin films of ferromagnet (Nickel/iron, permalloy) deposited onto a suitable substrate. The sensors are highly sensitive and directional in their response to magnetic fields. The sensors have a lower saturation magnetising field than the semiconductor variants (typically 0.01T). The temperature of operation of these sensors is higher with operation up to 200°C. These sensors exhibit a non-linear response to an induced magnetic field. The sensors can be supplied with integral bias magnet to correct this non-linear response.

Giant magneto-resistive sensors (GMR) are composed of copper alloy sandwiched between magnetic layers that are themselves sandwiches of cobalt and iron alloys. The variation in the resistance of the sensor element can be as great as 70%. The sensor element is highly directional and hence, the use as sensor elements in hard disk drives. We are currently developing a new geometry for this type of sensor, more details of which will be released in the near future.

Inductive sensors are typically larger and less sensitive than the MR variants. They do have the following advantages of lower cost (particularly for larger sensing area), simpler construction, easier to customise and they indicate the polarity of the induced magnetic field. The sensors can be simple air core coils or for higher sensitivity a high permeability core is used similar to a tape read head construction. One other critical advantage of the inductive sensors is that they can be designed to provide magnetising (write) as well as sensing (read) functions

We can combine the products listed opposite to form complex magnetic detector assemblies. The service we offer ranges from initial simulation to prototype manufacture through to full production. Please contact Semelab for a confidential discussion of your requirement and an update on our capabilities.

FEATURES

- HIGH SENSITIVITY
- LOW NOISE
- DIFFERENTIAL CONFIGURATIONS
- INTEGRAL BIAS MAGNETS
- COMPLETE DETECTOR SOLUTIONS
- SUITABLE FOR HIGH VOLUME MANUFACTURE

PRODUCTS

- SEMICONDUCTOR MR SENSORS
- FERROMAGNETIC MR SENSORS
- INDUCTIVE SENSORS
- MAGNETIC SENSOR ARRAYS

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ITEM	PRODUCT	DIMENSION		PARAMETER		COMBINED PRODUCTS
		DESCRIPTION	RANGE	DESCRIPTION	RANGE	
1	Semiconductor MR Sensor	Sensor Width	> = 1mm	Min. Field Detectable	~ 100nT	Integral bias Magnet. Differential Sensor Arrays.
		Spatial Resolution	~ 0.1mm	Saturation Field	0.1T	
				Resistance (H=0)	~ 0.5KΩ	
				$\Delta R_{SAT}/R$	< 2%	
2	Simple Ferromagnetic MR Sensor	Min.Sensor Width	< 0.1mm	Min. Field Detectable	< 50nT	Integral bias Magnet. Differential Sensor Arrays.
		Spatial Resolution	< 0.1mm	Saturation Field	< 0.01T	
				Resistance (H=0)	~ 2KΩ	
				$\Delta R_{SAT}/R$	< 2%	
3	Giant magnetoresistive Sensor (GMT)	Min.Sensor Width	< 1mm	Min. Field Detectable	< 10nT	Integral bias Magnet. Differential Sensor Arrays.
		Spatial Resolution	< 0.01mm	Saturation Field	< 0.01T	
				Resistance (H=0)	~ 5KΩ	
				$\Delta R_{SAT}/R$	30%	
4	Inductive Sensors	Sensor Active Area	< 1mm^2	Min. Field Detectable	< 100nT	Differential Sensor Arrays. Write Function
		Spatial Resolution	< 0.01mm	Saturation Field	< 1T	
5	Magnetic Sensor Arrays	Max. Array Length	> 200mm	Number of Elements	2 to n	Differential

The above is a summary of our experience to date, it should not be interpreted as the limitation of any particular geometry. If the specification of one of the particular sensor geometries does not suit your requirements, please contact Semelab plc for possible sensor options.

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Prelim. 6/98