

Giant Magnetoimpedance Sensor for Structural Integrity Assessment of Engineering Components

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Abstract

Investigation is focused on the development of sensor based on giant magnetoimpedance (GMI) effect using soft magnetic $\text{Co}_{66}\text{Fe}_2\text{Si}_{13}\text{B}_{15}\text{Cr}_4$ amorphous wire as sensing (core) element. The GMI property of the sensing element was utilized for fabrication of the sensor which is sensitive to the minute variation of the local magnetic field. The sensor output signal is calibrated with respect to external applied magnetic field and the sensitivity is found to be 56.11 mV/ μT . The sensor shows a good linear response and its repeatability and reproducibility are observed to be satisfactory.

The sensor is very much useful for detection of the localized magnetic field of service exposed engineering components within an external magnetic field using GMI sensor, and more specifically, to develop a GMI sensor for efficient monitoring of structural integrity of engineering components. The conventional non-destructive techniques like ultrasonic, eddy current, magnetic particle inspection are very useful to identify the defects or cracks. However, these methods are unsuitable for monitoring structural degradation. Since most of the structural components used in the industry are of ferromagnetic steel, the microstructural properties of the components due to their long service period influence the magnetic and mechanical properties. Therefore, the developed sensor could be used to detect the local magnetic field of the aging structure which changes with the microstructure of the component and thereby, assessing the integrity of the components.

Keywords: Giant Magnetoimpedance, amorphous wire, localized magnetic field, structural integrity.