

Mag-03 used in Active Cancellation in MRI Suites

Objectives

Mag-03 sensors are used as part of an active cancellation system to prevent magnetic field interference around MRI machines, in conjunction with shielding.

Instrumentation

Mag-03MS1000 precision three axis fluxgate magnetic field sensor.

Application

Active magnetic field cancellation systems.

Background

MRI machines use magnetic fields to carry out precision imaging techniques and are thus sensitive to external magnetic interference. External fields will interfere and distort the image quality.

Magnetic and RF shielding is often built into the walls of an MR controlled area. Shielding is passive and will cancel much of the static and alternating fields in the surrounding environment. Active cancellation systems are used around the MRI machines to negate any stray magnetic fields that penetrate the shielding and that occur in real time, e.g. a wheelchair being pushed past the room, by measuring field variations and cancelling them out.

Method

To detect any external magnetic interference that may affect the MRI system, the magnetic sensor must be positioned close to the machine. However, the field produced by the MRI magnet far exceeds the 1mT range of the Mag-03MS1000 and will easily saturate and potentially damage the sensor. Therefore the field from the MRI scanner must be cancelled out to prevent saturation and to enable the sensor to detect stray fields.

The Mag-03MS1000 is positioned next to the machine and aligned with the z-axis along the direction of the bore of the MRI magnet. Thus the magnetic field propagates parallel to the z-axis and perpendicular to the other two axes.

A field with equal magnitude to the MRI field, but in the opposite direction, is created by passing a current through a coil wound around the Mag-03MS1000. The result is a zero field measurement as the two fields will cancel each other out locally to the sensor. The sensor will now only detect external fields.

The sensor is then connected, via a control unit, to a set of Helmholtz Coils that are installed around the room, sometimes built into the walls. Any external fields detected by the Mag-03MS1000 are cancelled out by an opposing field created by the Helmholtz Coils, in the same way as a normal active cancellation system.

