Cost-Effective Imaging System Uses RF Magnetic Field and Loop Bolometer Array to Produce MRI-Quality Images

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Technology description

New system can generate detailed images of internal body structures and identify defects embedded in electronic circuits

UCF researchers have designed a new imaging system that captures detailed, 3D views of an object’s internal structures and is more affordable, compact and transportable than other systems. The invention is safe to use for both medical and scientific applications, since it does not require a radioactive source to create an image. For example, the system could visualize biological structures such as blood vessels, clots and internal hemorrhaging in a patient or detect and identify implanted medical devices. It may also enable the nondestructive testing and analysis of embedded electronic circuits and be used in identifying building defects, such as internal cracks or voids.

Today’s imaging devices, such as magnetic resonance imaging (MRI) systems and other nuclear magnetic resonance techniques, are complex, expensive systems that require a strong magnetic field with a large detector coil and a spatial encoding signal to determine the location of a particular image pixel. In contrast, the UCF invention employs a simpler design that uses smaller, less costly components, including a radio-frequency (RF) magnetic field radiator and a novel loop-shaped, resistive foil bolometer detector array. As well, the system does not require additional structures (like wave guides) to increase bolometer sensitivity, compared to existing uncooled metal foil RF bolometers.

Technical Details

The unique imaging system consists of an RF transmission source (such as a magnetic field radiator), an uncooled, loop-shaped, resistive foil bolometer detector array, an image processor, and a display. As shown in Figure 1, an object of interest is positioned between the RF transmission source and the loop bolometer array. During operation, RF signals generated by the transmission source pass through the object, causing spatially varying flux density at the loop elements. The local flux density at a particular loop element induces current within the loop, causing Joule heating that results in a detectable resistance change within a bolometer circuit. The output is converted to a pixel intensity which is then combined spatially with the remaining elements to produce a composite “magnetic image.

Application area

Medical or scientific imager
Non-destructive analysis of electronic circuits
Imaging system for implanted medical device identification markings

Advantages

High quality, MRI-like images without using radioactive sources
More compact and affordable than MRI systems
Enables nondestructive analysis of electronic circuits/objects that cannot be submerged in a fluid bath
Improves the ability to isolate RF leakage locations and differentiate between radiation sources in closer proximity

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