Mechanical Force Detection of Magnetic Fields Using Heterodyne Demodulation

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a new, high-frequency magnetic field detector that uses mechanical force to directly detect a magnetic field.

Overview

Although detecting high-frequency magnetic fields is important in MRI, NMR and magnetic resonance force microscopes, it is more difficult to design magnetic field sensors at high frequencies (greater than 1 GHz) than at low frequencies. The sensors most commonly used for high-frequency magnetic sensing are inductive coils, where current induced in a coil is measured and the magnetic field is inferred from this measurement.

The Invention

UW-Madison researchers have developed a new, high-frequency magnetic field detector that uses mechanical force to directly detect a magnetic field. The device incorporates a coil-on-cantilever design, with a conductive loop placed on a vibrating cantilever beam with one fixed end. The frequency of the alternating current in the loop is chosen so the magnitude of the cantilever's mechanical vibration at its mechanical resonant frequency reflects the magnitude of the magnetic field. The vibration of the cantilever is then detected by reflecting a laser beam off a reflective portion at the cantilever's free end.

Applications

- Detecting alternating magnetic fields in extremely narrow frequency ranges for MRI, NMR or magnetic resonance force microscopes

Key Benefits

- Significantly reduces noise and improves sensitivity as compared to inductive coil sensors
- Could improve the spatial resolution of MRI devices
- Minimizes the amount of metal in the vicinity of the MRI magnetic field
- Can be adapted for NMR analysis
- Compact size
- Multiple cantilevers and loops can be integrated into a single device to allow simultaneous parallel detection of multiple frequencies.

Additional Information

For More Information About the Inventors

- Daniel van der Weide
- Thomas Grist

Tech Fields

- Analytical Instrumentation, Methods & Materials : Microscopy
- Medical Imaging : MRI

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846