Sensors

Magnetic Field Response Measurement Acquisition System

A system that provides power to and receives measurements from wireless inductance-capacitance sensors

NASA's Langley Research Center researchers have developed a measurement acquisition system that uses magnetic fields to provide power to sensors and to acquire physical property measurements from them. Unlike traditional acquisition devices, this system has the ability to make multiple measurements of different, non-related physical properties without the constraint of a limited number of data acquisition channels. Winner of the prestigious R&D 100 award, this technology has been demonstrated with a leading aircraft landing gear manufacturer to wirelessly measure the fluid levels in landing gear shock struts. In addition to fluid level, rotation, temperature, material phase changes, proximity, position, and volume measurements have all been demonstrated.

BENEFITS

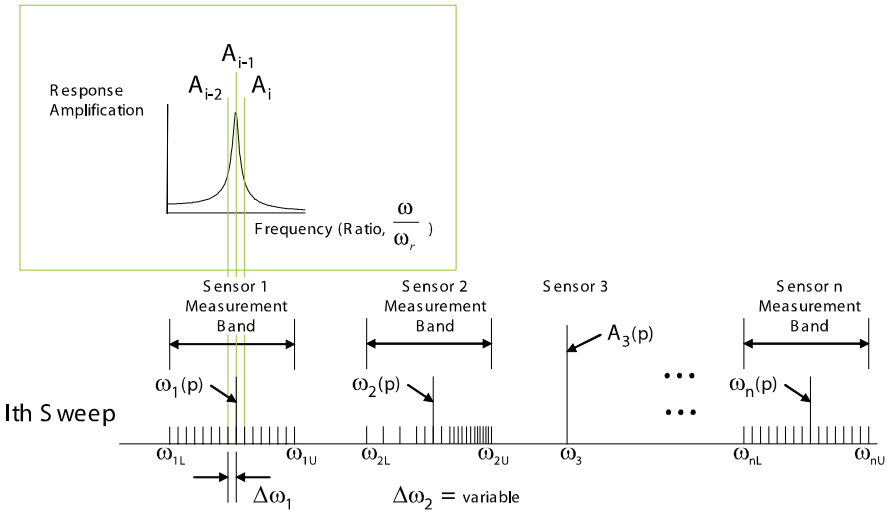
- Provides power wirelessly to sensors, eliminating the need for a sensor power source
- Acquires signals from sensors wirelessly, eliminating signal wiring
- Reduces system weight due to less wiring
- Eliminates risk of electrical arcing in explosive conditions
- Enables use under corrosive, radioactive, extreme temperature, and other hazardous conditions
- Enables measurements in areas previously impractical to reach due to wiring constraints
- Scales to allow the easy addition of new sensors
- Measures multiple non-related physical properties simultaneously, eliminating the limitations on the number of acquisition channels required for traditional data acquisition systems

technology solution

THE TECHNOLOGY

This measurement acquisition device uses magnetic fields to power and interrogate passive inductor-capacitor sensors. The measurement acquisition system produces a series of increasing magnetic-field harmonics within a frequency range dedicated to each sensor. Faraday induction via the harmonic magnetic fields produces a current in the sensor.

Once electrically active, the sensor produces its own harmonic magnetic field as the inductor stores and releases magnetic energy. The antenna of the measurement acquisition system is switched from a transmitting to a receiving mode to acquire the magnetic-field response of the sensor. The magnetic-field response attributes of frequency, amplitude, and bandwidth of the inductor correspond to the physical property states measured by the sensor. The received response is correlated to calibration data to determine the measurement.



Magnetic field response sensor measurement bands and resolution during frequency sweeps

APPLICATIONS

The technology offers wide-ranging market applications, including:

Automotive, motor sports, and trucking – tire pressure, tread wear, wheel speed, fuel level, and engine temperature

Aerospace – landing gear health, fuselage integrity

Industrial – foundry kiln temperature, cryogenic liquid level, materials cure process

PUBLICATIONS

U.S. Patent No. 7,075,295
U.S. Patent No. 7,086,593
U.S. Patent No. 7,159,774
U.S. Patent No. 7,589,525
U.S. Patent No. 6,879,893
U.S. Patent No. 7,047,807

More Information

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