National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Sensors

Low-Profile Wireless Sensor

A wireless inductance-capacitance sensor suitable for small packaging

NASA's Langley Research Center researchers have developed a wireless low-profile sensor that uses a magnetic field response measurement acquisition system to provide power to the sensor and to acquire physical property measurements from it. Unique to this sensor is the shape of the electrical traces
that eliminates the need for separate inductance, capacitance, and connection circuitry. This feature gives the sensor a smaller circuit footprint to enable a smaller, flexible, and easy to fabricate sensor package. The shape of the electrical trace can be readily modified to sense different physical properties.
Also, arranging multiple low-profile sensors together can permit the wireless data acquisition system to read the responses from all the sensors by powering just one of them.

BENEFITS

- Receives power wirelessly, eliminating the need for a sensor power source
- Sends signals wirelessly to the data acquisition device, eliminating signal wiring
- Reduces system weight due to less wiring
- Eliminates risk of electrical arcing in explosive conditions
- Capacitor and inductor combined to allow for a smaller profile
- Reduces the number of electrical connections within the circuit, improving reliability
- Easily modified to provide different response characteristics for sensing different physical properties
- Inductive coupling of adjacent sensors requires only one sensor to be powered to obtain a full response from all sensors
- Enables use under corrosive, radioactive, extreme temperature, and other hazardous conditions

THE TECHNOLOGY

The low-profile sensor is configured with a spiral electrical trace on flexible substrate. In typical inductor designs, the space between traces is designed to minimize parasitic conductance to reduce the impact of the capacitance to neighboring electronics. In the low-profile sensor, however, greater capacitance is desired to allow the operation of an inductor-capacitor circuit. This allows the traces to be closer together, decreasing the
overall size of the spiral trace.

The sensor receives a signal from the accompanying magnetic field data acquisition system. 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 physical property measurement. When multiple sensors are inductively coupled, the data acquisition system needs to activate and read
only one sensor to obtain measurement data from all of them.

This NASA technology has applications in the automotive industry.

APPLICATIONS

The technology has several potential applications:

- 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

Patent No: 8,430,327

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More Information

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