



NASA Langley's Wireless Electrical Devices Using Floating Electrodes

Fundamental new approach for developing electrical devices that need no external power source or electrical connections

NASA Langley researchers have developed a wireless, connection-free, open circuit technology that can be used for developing electrical devices such as sensors that need no physical contact with the properties being measured. At the core of the technology is the SansEC [Sans Electrical Connections] circuit, which is damage resilient and environmentally friendly to manufacture and use. The technology uses a NASA award-winning magnetic field response measurement acquisition device to provide power to the device and, in the case of a sensor application, to acquire physical property measurements from them. This fundamental new approach using open circuits enables applications such as sensors for axial load force, linear displacement, rotation, strain, pressure, torque, and motion sensing, as well as unique designs such as for a wireless keypad or wireless rotational dial, or for energy storage.

Benefits

- Can measure shear force, torsion, in-plane strain, and relative position of two planes without electrical connections on either surface or between surfaces
- Out-of-plane measurements have sensitivity levels an order of magnitude better than other measurement methods
- One sensor can be used for multiple measurements
- 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 and size due to less wiring
- Lowers the number of electrical connections within the circuit, improving reliability
- Can be mass produced, and is well suited for manufacture to a specific size
- Can operate inside a package or container, protecting the sensor from damage by environmental elements

partnership opportunity





Applications

The technology offers wide-ranging market applications, including:

- Automation control – linear position sensors
- Security systems – wireless keypads and motion detectors
- Aerospace – testing and monitoring

The Technology

The technology presents a fundamental change in the way electrical devices are designed, using an open circuit in conjunction with a “floating electrode,” or an electrically conductive object not connected to anything by wires, and powered through a wireless device. This system uses inductor-capacitor thin-film open circuit technology. It consists of a uniquely designed, electrically conductive geometric pattern that stores energy in both electric and magnetic fields, along with a floating electrode in proximity to the open circuit. When wirelessly pulsed from the handheld data acquisition system (U.S. Patent Number 7,159,774, Magnetic Field Response Measurement Acquisition System), the system becomes electrically active and develops a capacitance between the two circuit surfaces. The result is a device that acts as a parallel plate capacitor without electrical connections. When applied to strain measurements, the sensor has been demonstrated to have a displacement and strain resolution of $3.9\mu\text{m}$ and $0.6\mu\epsilon$, respectively.

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

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