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Wireless Temperature and Vibration Sensor for Real-Time Bearing Condition Monitoring

A unique wireless sensor simultaneously monitors both temperature and vibration in rotating mechanical components using inductive coupling, enabling real-time condition monitoring and predictive maintenance.

Temperature and vibration measurements are important in mechanical systems to detect impending failures and predict component lifetimes. Most existing systems use separate sensors to detect temperature and vibration and require wired systems, which are difficult to mount on rotating parts such as bearing cages. Inductive-coupling and infrared radiation based wireless sensors have been used to measure temperature, and other commercial sensors have been proven to accurately detect vibrations in bearing housings, but no such sensors have been developed to measure both. Sensors utilizing MEMS and optical methods are capable for measuring vibration, strain, and temperature, but are highly unreliable in harsh environments where debris, such as dirt and oil, is present.

Researchers at Purdue University have developed a unique wireless sensor capable of sensing both temperature and vibration of a bearing cage simultaneously using inductive coupling. The system uses only a temperature-sensitive capacitor, a sensor coil, and an interrogator coil. Both the temperature and vibration measurements are then detected through reactions between the bearing and the coils. The sensor was able to accurately detect temperatures up to 90 degrees Celsius and several vibration frequencies at various shaft speeds.

Advantages:

-Uses only one sensor to detect both temperature and vibration

-Wireless and real-time monitoring

Potential Applications:

-Maintenance/monitoring of mechanical components

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Category

Robotics & Automation/Perception & Sensing

Robotics & Automation/Automation & Control

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