

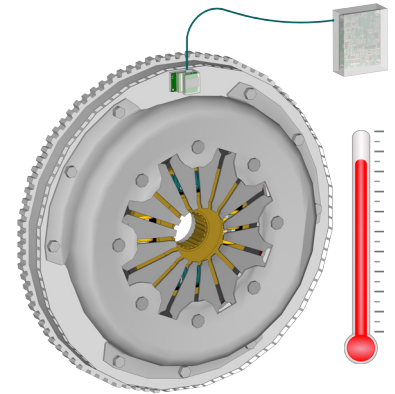
RotoTemp

Precise contactless temperature measurement on rotating assemblies



Technology Highlights

- reliable high accuracy temperature measurement system for on-condition monitoring of rotating machinery
- contactless power supply and near-field data transmission
- ultra-low power design for sensor module miniaturization
- optimized for easy and minimally invasive installation
- reliable operation in harsh environments (vibration, shock, high temperature etc.)



Technology Overview

The RotoTemp technology is designed for **high accuracy contactless temperature measurement** on rotating mechanical assemblies with **very small space** requirements for system installation. Based on a patent pending design, the technology minimizes the power consumption, dimensions and mass of a sensor module on the rotating side of the system, thus enabling minimally invasive system installation regarding requirements for mechanical assembly adaptation, unlike the most of currently available competing technologies.

Technology is optimized for temperature monitoring of various **drivetrain elements** (such as clutches, brakes, shafts, motor parts and other similar objects). Technology can be adapted for measurement of **other physical quantities** (e.g. force, torque, pressure etc.). **Evaluation kit** for technology demonstration is available upon request free of charge. Experienced and supportive **research and development team** is available for consulting and project-based collaboration towards adaptation and further development of technology in accordance to specific customers' needs.

System Description and Operation Overview

The RotoTemp system consists of three main parts: sensor module, wireless driver module and processor module. The *sensor module* is mounted on a rotating object and interfaced with a resistive-type (RTD) temperature sensor. The sensor module receives power and sends measurement data to a *wireless driver module* during a short time period when the modules are in a close proximity to each other within one rotation cycle. Wireless driver module is powered from a *processor board*, which analyzes and processes measurement data received from wireless driver module in a real-time by means of digital signal processing algorithms. Processor board can be interfaced with external systems via 4-20 mA current loop, asynchronous serial port (UART) and CAN protocol.

KEY WORDS → telemetry | contactless measurement | sensor | rotating assembly measurement | temperature measurement | drivetrain elements | contactless power/signal transmission

Prototype Technical Information

SENSOR MODULE

PARAMETER	DESCRIPTION
Sensor type ¹	RTD temperature sensor
Measurement accuracy ²	~ 1 °C
Power supply	wireless, inductively coupled
Power consumption	~ 2.5 mW
FM carrier frequency	70-150 kHz
Wireless power supply operational frequency	1.9 MHz
Dimensions ³	37 x 28 x 13 mm
Mass	22 g
Temperature range ⁴	-40 to 125° C
Environmental protection	IP68

- 1 Any resistive type sensor can be interfaced to the sensor input
- 2 Parameter describes electronic measurement chain uncertainty under worst-case conditions
- 3 Technology allows for further minimization of dimensions of demo prototype evaluation module
- 4 This range applies to the environmental conditions where the electronic module is mounted; measurement range may be wider and it is determined by the sensor limits; operational temperature range of electronic module can be extended by using special extended temperature range components in production system

PROCESSOR MODULE

PARAMETER	DESCRIPTION
Power supply	12-24 V / 0.5 A
Interfaces	4-20 mA, UART, CAN
Dimensions (PCB)	46 x 56 mm
Mass (PCB)	13 g
Temperature range	-40 to 85° C

Key Benefits and Target Applications

- > On-condition real-time monitoring & predictive maintenance
- > Mechanical assemblies wear optimization and improved parts replacement prediction
- > Prototype vehicles assessment and development of new drivetrain systems
- > Safety improvements in production vehicles and machinery
- > Target industries: automotive, aerospace, shipbuilding, tooling machines production
- > Possible to adapt the technology for measurement of other physical quantities

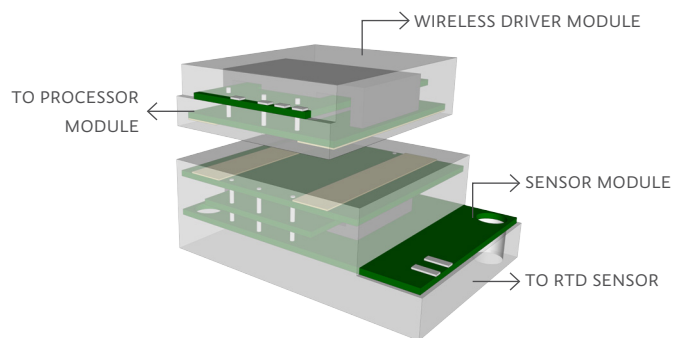
Research Group and Team

Sensor and Electronic Instrumentation Research Group at the University of Zagreb Faculty of Electrical Engineering and Computing, Croatia, led by Professors Mario Cifrek and Hrvoje Džapo, focuses on research in the fields of sensor technologies, measurement methods, electronic measurement system design, real-time embedded systems and signal processing. Applied research projects encompass various applications in wireless sensor networks, industrial applications, on-condition monitoring, safety-critical embedded systems, precision localization, home automation and traffic.

WIRELESS DRIVER MODULE

PARAMETER	DESCRIPTION
Operating distance ¹	~ 5 mm
Driving voltage	12-24 V
Rotational speed ²	200 - 6000 min ⁻¹
Dimensions	30 x 24 x 8 mm
Mass	12 g
Temperature range	-40 to 125° C
Environmental protection	IP68

- 1 Maximum operating distance between sensor and wireless driver module when they are in a close proximity during rotation to allow for a sufficient energy transfer and quality sensor measurement readout, within the specified accuracy limits (under the assumption of about 1-2% coverage of rotational element circumference by a small sensor module; greater operating distance can be achieved with larger sensor module)
- 2 Minimum rotational speed limit is required to provide a continuous power supply to the sensor module through the series of repetitive power pulses; maximum rotational speed limit is related to conditions of very short coupling time during which it is necessary to transfer enough power for sensor module power supply and to receive sensor signal sequence long enough to provide quality readout within the specified measurement accuracy limits



Development Status

- > Prototype demo measurement system developed and tested
- > Evaluation system available on request for technology assessment

Cooperation Options

- > License agreement
- > Prototype hardware production documentation and embedded software for measurement data processing
- > Integration support and project-based R&D cooperation

IPR Status

- > National patent application in Croatia and PCT application filed
- > Technology is developed by the University of Zagreb Faculty of Electrical Engineering and Computing, Croatia

CONTACT

Vlatka Petrović, Ph. D.
Technology Transfer Office
University of Zagreb
Trg Republike Hrvatske 14, HR-10000
Croatia
PHONE +385 (0)1 4698 164
E-MAIL vlatka.petrovic@unizg.hr

