

Sensor operates as a result of the measurement of a difference between two interfering light beams propagating around closed (very long) optical path, in opposite direction,

- Unique high-accuracy technology, so far available from 2 countries only;
- Sagnac effect, independent on Earth Gravity, for which the only frame of reference is Einstein's space-time;

Sensor produces high resolution Big Data output for a next step profile computing.

Main business profiles are: Microseismic sensing (gas & oil, thermal water, mining industry), military, autonomous vehicles (autonomous cargo-ships/drones/plains/robots),

FOSREM is a new approach to measurement of angular velocity and angels with

Searching destructive rotary forces inside skyscrapers



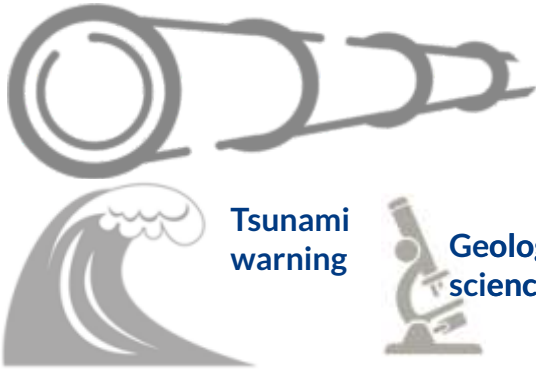
Searching resources microseismic reflection sensing



Gas & Oil searching



Gas/Oil pipelines monitoring

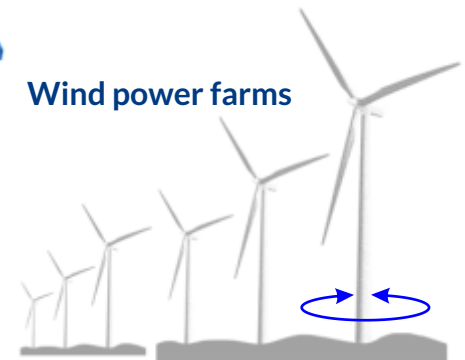


Tsunami warning

Geology science



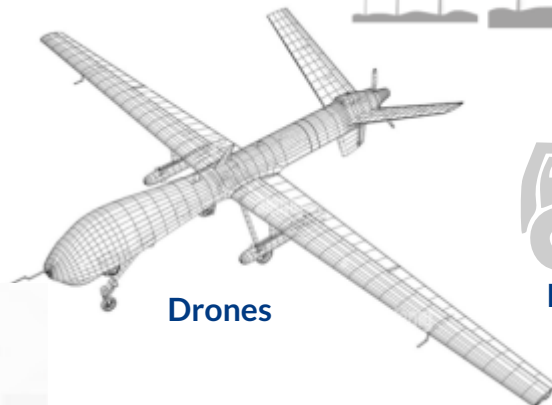
Wind power farms



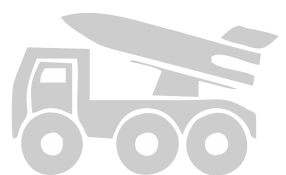
Autonomous cargo-ships



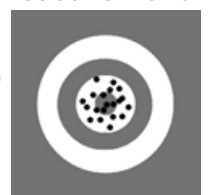
Autonomous harbours



Drones



Measurement



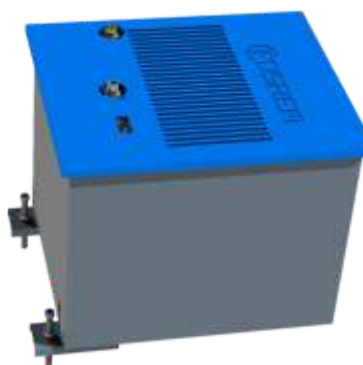
3-Axial sensors for autonomous vehicles & space industry

from calibration up to inertial navigation & angle measurement

Technical parameters

Rotational rate dynamic range	10 rad/s	Sensitivity	$2,5 \cdot 10^{-8}$ rad/s/ $\sqrt{\text{Hz}}$
Pass band	from 0.01 to 100 Hz	Configuration	Closed-loop configuration with digital processing
Communication	Ethternet, WiFi, 3G/4G WWLAN, miniSSED (TCP/UDP), PTP for time stamping, GNSS	Data storage	Up to 512GB SSD in PCU can store up to 30 days of measurement data
Interfaces	1Gbps RJ-45 with PoE and PTP	Management	Local and remote management and data acquisition over Internet
Power Supply	12 - 24 VDC, via PCU over PoE, power consumption less than 20W	Dimensions {L x W x W}	360 x 300 x 295mm
Ingress protection	IP66	Weight	20 kg

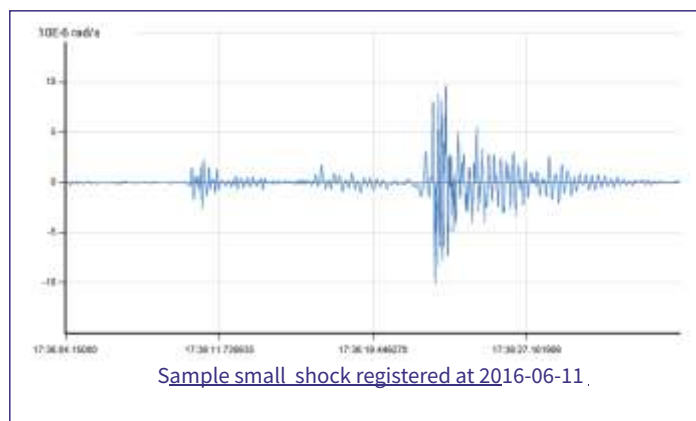
FOSREM – Fibre-Optic System for Rotational Events Monitoring is a mobile fibre-optic system based on Sagnac interferometer for any application in rotational seismology area of interest. It is also the 3-axial FOG (Fiber Optic Gyroscope). The sensor is optimised for measurement of the rotational rate (angular velocity) with sensitivity equal to about $2 \cdot 10^{-8}$ rad/s/ $\sqrt{\text{Hz}}$ in the pass band from 0.01 to 100 Hz. The above-mentioned sensitivity and rotation rate dynamic range up to 10 rad/s, covers weak as well as strong rotational motions connected with irregular object movements occurring during solid winds, tectonics and earthquakes. In this way, the FOSREM is dedicated to monitoring the rotational vibration in objects like wind power plants, tall buildings, bridges, unstable grounds, and any earthquake-related rotational events.



Seismograph Applications

The FOSREM can study geological structures in a new area of rotation seismology (earthquake engineering). Utilising multiple, synchronous operating sensors allows for achieving a new research perspectives like Microseismic Reflection Sensing. Dozens of sensors can work in one worldwide network, transferring Big Data to a central cloud-based system. The data can be viewed and analysed remotely from anywhere. Moreover, control and setup of each sensor are done via the network. Using encrypted VPN network connections ensures data safety and reliability of the measurements. Construction of FOSREM includes the FOS sensor and Power & Communication Unit (PCU). The central part is the FOS three-axial FOG-based sensor which contains a three fibre-optic Sagnac interferometer with a 250 mm diameter fibre-optics

loop, a DSP unit with a Linux and power conversion PCU management parts. All of these are placed in a robust case and meet the IP66 requirements. This internal DSP unit provides rotation speed (Ω) value directly in digital form sampling resolution of 1000 samples/s., The connection provides data transmission and power supply over only one standard STP cable within 100 m. All measurements are synchronised to UTC using PTP IEEE1588 protocol with time reference from GNSS. The PCU connects the FOSREM device to the Internet over the Ethernet, WiFi local networks or 3G/4G/5G mobile networks. In addition the system provides VPN functionality. Thanks to connecting multiple FOS sensors in one synchronised sensor network, the new functionalities are available such as micro-seismic reflection scanning (sensor fusion). It enables a new area of an industry searching for water, gas & oil.



Gyroscope Applications

FOSREM is also a Fiber Optic Gyroscope (FOG) device. Elproma offers a special miniaturised version of the device designed for autonomous vehicles, such as autonomous cargo ships, drones, aeroplanes and space vehicles.

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