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FOSREM - Fibre-Optic System for Rotational Events&Phenomena Monitoring

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We present the construction and tests of fiber-optic rotational seismometer named FOSREM (Fibre-Optic System for Rotational Events&Phenomena Monitoring). This presented device is designed for detection and monitoring the one-axis rotational motions, brought about to ground or human-made structures both by seismic events and the creep processes. The presented system works by measuring Sagnac effect and generally consists of two basic elements: optical sensor and electronic part. The optical sensor is based on so-called the minimum configuration of FOG (Fibre-Optic Gyroscope) where the Sagnac effect produces a phase shift between two counter-propagating light beams proportional to the measured rotation speed. The main advantage of the sensor of this type is its complete insensitivity to linear motions and a direct measurement of rotational speed. It may work even when tilted, moreover, used in continuous mode it may record the tilt.
The electronic system, involving specific electronic solutions, calculates and records rotational events data by realizing synchronous in a digital form by using 32 bit DSP (Digital Signal Processing). Storage data and system control are realised over the internet by using connection between FOSREM and GSM/GPS. The most significant attribute of our system is possibility to measure rotation in wide range both amplitude up to 10 rad/s and frequency up to 328.12 Hz. Application of the wideband, low coherence and high power superluminescent diode with long fibre loop and suitable low losses optical elements assures the theoretical sensitivity of the system equal to 2·10-8 rad/s/Sqrt(Hz).
Moreover, the FOSREM is fully remote controlled as well as is suited for continuous, autonomous work in very long period of time (weeks, months, even years), so it is useful for systematic seismological investigation at any place.
Possible applications of this system include seismic monitoring in observatories, buildings, mines and even on glaciers and in their vicinity. In geodetic, geomorphological and glaciological survey, joint measurement of tilt and seismic phenomena using a set of three FOSREM devices oriented in perpendicular planes would enable to collect very important information.