



Theoretical background

Sagnac's original experiment used a loop about 1m square and detected fringes when the loop rotated at a few times a second.

The observed fringe shift does not depend on:

- the shape of surface area S,
- the location of the center of rotation,
- the presence of a comoving refracting medium in the path of the beam.

$$DZ(=Dj) = 4WS / c$$

Sagnac effect - 1913 underground and properties

Solution

$$f_s = \frac{2pLD}{lc} W$$

The phase shift increase with loop diameter D and fiber length L - practical way for FOSREM development.

REALISATION

Optical unit

W_{min} in quantum noise limitation [Ostryżek, 1989]

$$W_{min} = \frac{1}{\sqrt{DB}} \times \frac{4 \times \sqrt{2} \times 10^{10} \times 1000}{4p \times R \times L \times S \times I_p \times (1.84) \times P_s \times 10^{-5} \times 10^9 \times 10^{10} \times 1000} \times \sqrt{\frac{V_d^2}{R_0^2} + \frac{1}{8} \times e \times S \times P_s \times 10^{-5} \times 10^9 \times 10^{10} \times 1000} \times (1 + X) + \frac{4 \times k \times T}{R_0} + I_d^2$$

where: DB - detection bandpass, c - light speed in vacuum, l - optical wavelength, R - sensor loop radius, L - fibre length, a - fibre attenuation in dB/km, s - total loss in optical part (without loss of used fibre in sensor loop), P_s - optical power of used source, S - sensitivity of used photodiode, V_d, I_d - dark voltage and current of photodiode, R₀ - photodiode impedance, e - electron charge, k - Boltzmann constant, T - temperature.

FOSREM theoretical sensitivity

$$W_{min} = 2 \cdot 10^{-8} \text{ [rad/s/Hz}^{1/2}]$$

FOSREM DEVICE

DSPµ-computer Analog&ADC

Connectivity:

- Ethernet 100Mbps,
- WiFi 802.11n,
- WAN 3G/HDSPA

Time synchronisation:

- GPS+GALILEO

Features:

- Internal Access Point for device configuration
- WiFi client and AP
- Web-Based Management Interface
- GPS precise time synchronisation - multi device synchronous operation.
- Telemetry Server for store and analysis data.

Technical Specifications:

- Weight: 25kg,
- Dimensions: 47x23x36 cm
- Battery Capacity: 288Wh (20Ah, 14.4V LiIon)
- Operating System: Linux
- Power: 100-240V AC, 20W

FOSREM SERVER

FOSREM Telemetry Server stores data from multiple devices. It allows for data analysing as well as their displaying. The user can store information from FOSREM on his own computer. FOSREM Telemetry Server is used for remote control of the key parameters for all managing devices.