Magnetometer Based On Spin Wave Interferometer

Tech ID: 32668 / UC Case 2017-150-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,243,276	02/08/2022	2017-150

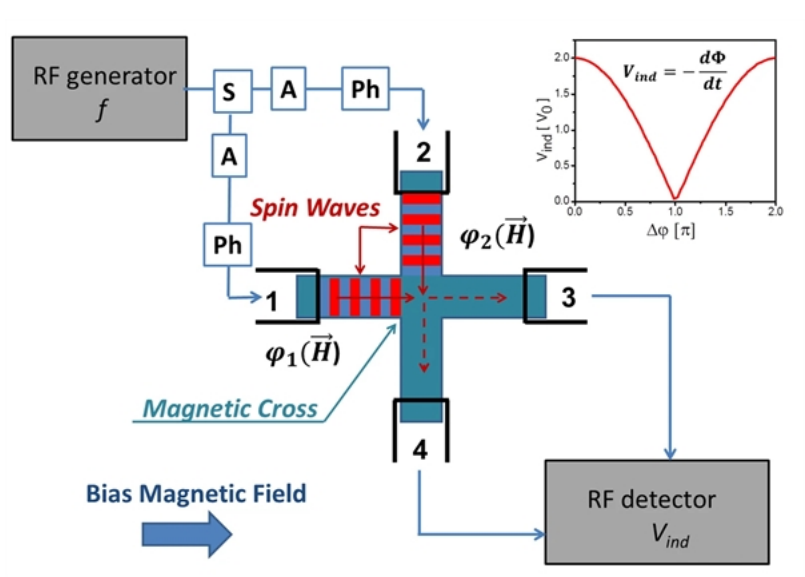
FULL DESCRIPTION

Background

Magnetometers are among the most widely used instruments for a variety of applications. Sensitivity, intrinsic noise, size, energy budget and cost are the important characteristics of magnetometers. A variety of magnetic sensors, in currently available magnetometers, are available based on their unique advantages and the intended application. Some of the highly sensitive magnetometers are plagued by high cost and require cryogenic temperatures for operation. The cheaper magnetometers are also less sensitive. These challenges continue to hinder practical application of magnetometers for a wide variety of uses.

Current Invention

Prof. Aleksandr Khitun has developed a patent pending, novel magnetometer based on spin wave interferometer. The sensing element for this instrument consists of a magnetic cross junction with four micro-antennas fabricated at the edges. Two of these antennas are used for spin wave excitation and the other two are used for detection of the inductive voltages generated by the interference of the spin waves. The output voltage attains its maximum or minimum depending on if the spin waves are coming in phase (constructive interference) or out of phase (destructive interference), respectively. The maximum sensitivity is during destructive interference.



Schematics of the sensing element – a spin wave interferometer built on a magnetic cross junction.

ADVANTAGES

The significance and benefits of this innovation are:

- High sensitivity – 10^{-16} T/√ Hz
- Small size – prototype is 3mm X 3mm X 0.1mm with the potential to go to nanometer scale.
- High operational frequency – 1GHz – 10GHz

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OTHER INFORMATION

KEYWORDS

Magnetic sensor, Spin wave interferometer, Submarine tracking, Tracking and detecting, Brain impulse monitoring, Gas pipeline monitoring, Space telescopes

CATEGORIZED AS

- **Energy**
  - Hydrocarbon
  - Hydrogen
- **Environment**
  - Sensing
- **Medical**
  - Research Tools
- **Security and Defense**
  - Screening/Imaging
- **Sensors & Instrumentation**
  - Physical Measurement
  - Position sensors
  - Scientific/Research

RELATED CASES

2017-150-0

- Simplicity and low cost
- Compatible with common electronic devices including smartphones
- Room temperature operation

SUGGESTED USES

- Tracking distant objects such as submarines (1 – 10 km)
- Tracking small objects such as weapons (at 50 m)
- Detecting electromagnetic impulses in the brain
- Gas pipeline monitoring.
- Space telescopes

STATE OF DEVELOPMENT

Lab level prototype built and tested

INVENTIONS BY ALEKSANDR KHITUN

All inventions by Aleksandr Khitun

RELATED MATERIALS

- A Magnetometer Based on a Spin Wave Interferometer

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