Spin-wave tunable transport in the reconfigurable magnonic waveguides

V. Gubanov,[1] S. Sheshukova,[1] E. Beginin,[1] A. Sadovnikov,[1] M. Precner,[2] V. Cambel,[2] and S. Nikitov[3]

[1] *Saratov State University, Astrakhanskaya Street 83, Saratov, 410012, Russia*
[2] *Institute of Electrical Engineering, Slovak Academy of Sciences, Dubravska Cesta 9, SK-841-04 Bratislava, Slovakia*
[3] *Kotel'nikov Institute of Radioengineering and Electronics, Russian Academy of Sciences, Moscow 125009, Russia*

The study of physical principles that determine the possibility of using spin waves (SW) to create information signal processing devices based on magnonics principles is of great interest [1]. Microstructures based on the iron-yttrium garnet (YIG) can be used in the processing of spin-wave signals due to the low attenuation. To control the properties of propagating spin waves (SW), the method of structuring YIG films and creating irregular micro- and nanoscale waveguides, including structures with broken translational symmetry, can be used [2].

In this work, the numerical simulations results of the spin wave propagation in a magnonic irregular microwaveguide, as well as the propagation of spin waves when creating a temperature gradient by laser radiation [3] in the waveguide curvature region are presented. The structure is an irregular YIG microwaveguide with a width of $w = 500\ \mu m$, thick $d_1 = 10\ \mu m$ placed at 500 μm-thick (d_2) gadolinium gallium garnet (GGG) substrate. The structure was placed in an external magnetic field with the magnitude $H_0 = 1200\ Oe$ directed along the x-axis in order to excite a magnetostatic surface wave (MSSW).

By the means of Brillouin light scattering technique, we obtained 2-D intensity maps of the spin wave propagating in the structure in the case of laser heating is on and off.

It is shown that control of SW propagation characteristics is possible due to the inhomogeneous configuration of the internal magnetic field along the direction of SW propagation. Also, the main operating modes of the proposed structure were revealed with local modulation of the structure properties (magnetization and the internal magnetic field by laser heating).

References:

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