MICROWAVE ACTIVE RING RESONATOR BASED ON SPIN-WAVE DELAY LINE

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During the past two decades the increased research interest to active ring systems is observed [1, 2]. Tunable microwave active ring resonators or oscillators can be easily fabricated with the use of delay lines based on the thin ferrite films such as epitaxial yttrium iron garnet (YIG) films. The aim of the work is theoretical and experimental investigation of the spin-wave active-ring resonators. Designed circuitry consists of spin-wave delay line, variable attenuator, microwave amplifier and two directional couplers for input and output signals. All elements of the scheme are connected consequently in order to form the closed loop. The transmission coefficient of this circuit has multiresonance behaviour at frequencies determined by the dispersion law of the spin waves in the delay line. For resonance frequencies phase shift of the microwave signal circulating in the ring is equal to $\Delta\varphi = 2\pi n$, where n is a number of the signal circulations. A complex transmission coefficient of the oscillator circuit was found in analytical form as a ratio of the output and input complex amplitudes. Detailed expressions of amplitude-frequency and phase-frequency characteristics will be presented at the conference.

For experimental investigation, the spin-wave delay lines were utilized a single-crystal YIG films grown on a gadolinium gallium garnet substrate by liquid phase epitaxy. The films had a width of 2 mm, a length of 40 mm, various saturation magnetization M_0 of 1750, 1660, and 1780 *G*, and various thickness L of 5.7, 9.64, and 13.6 μm, respectively. The SW delay lines were placed between the poles of permanent magnet. The bias magnetic field H_0 in a range from 1226 Oe to 1330 Oe was applied parallel to the plane of the YIG and to the antennae.

Theoretical dependences for frequency response well coincided with experimental results. Features of the transmission characteristic control by change of the distance between antennae and the external magnetic field were investigated. The quality factor was about $2 \cdot 10^4$. Therefore, the active ring resonators are promising for microwave applications, in particular for multiband filtering [3].

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