WAVEGUIDE-COAXIAL GYROMAGNETIC FILTERS

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The construction of gyromagnetic filters with waveguide outputs has a number of specific features compared with filters having coaxial outputs. To ensure that there is a sufficient level of decoupling between the inputs of the filter it is necessary to use, as a minimum, two gyromagnetic resonators. The waveguide constructions using crossed orthogonal waveguides in which both gyromagnetic resonators (GR) are situated on the axis of the magnetic system parallel to the direction of the constant magnetic field $H_0$ enables one to obtain sufficiently high decoupling between the inputs, but the gap between the poles of the magnetic system in existing constructions is not less than 2.5-3 mm. This makes the external dimensions and mass of the controlling electromagnets quite large and they therefore consume a considerable amount of power.

Waveguide constructions in which the coupling between the gyromagnetic resonators is achieved through an iris situated parallel to the direction of the constant magnetic field $H_0$ have not become widely used because of the low decoupling outside of resonance, due to parasitic transmission of microwave energy through the hole in the iris.

We will consider an original construction [1] of a two-resonator filter based on gyromagnetic resonators with waveguide outputs in which the optimum form is obtained by a compromise between constancy of the parameters of the amplitude-frequency characteristic for tuning over a band, and an improvement in the mass/size characteristics, while simultaneously ensuring a high degree of decoupling outside of resonance.

The waveguide-coaxial filter (Fig. 1) consists of two short-circuited orthogonal sections of rectangular waveguides coupled by means of a section of coaxial line. To ensure that the electromagnetic-field distribution in the region of the plane of the short circuit, formed on one side by the waveguide wall and on the other by the metal sheath of the rigid coaxial-line used, should be symmetrical about the axis of each of the waveguides, we made local depressions in the centers of the short-circuiting walls of the waveguides approximately equal to the external diameter of the section of coaxial line. In these depressions we placed gyromagnetic resonators which were attached and oriented in space using dielectric holders. The gyromagnetic resonators were coupled to the section of coaxial line by loop coupling elements, one of the ends of which was connected to the central conductor of the coaxial line, and the other to the body of the waveguide. The dimensions of the loop coupling elements, in order to reduce their inductance, were chosen to be as small as possible, in which case their radius is not less than the diameter of the gyromagnetic resonators employed to ensure a uniform microwave field at the points where the resonators were situated, and thereby reduce the level of parasitic oscillations. To reduce the distance (along a straight line) between the centers of the gyromagnetic resonators we chose an orthogonal arrangement of the waveguides. This is necessary to produce a more uniform constant magnetic field between the poles of the electromagnetic at the points where the gyromagnetic resonators were situated, and to reduce the diameter of the pole pieces. The diameter of the coaxial line was chosen taking into account the requirements imposed on the value of the gap between the poles of the electromagnet. At points where the coaxial line and the loop coupling elements were connected, the coaxial line lay in the plane of the corresponding loop coupling element, which ensures that the coaxial line is excited by the current of the loop coupling element at the resonance frequency.

Since the planes of the loop coupling elements are parallel to the planes of the short circuit in the corresponding waveguides and the loop elements are situated on the axes of the waveguides, the currents in them are not excited by the waveguide fields when
REFERENCES


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