Abstracts

Theory of Magnetostatic Waves in Moving Ferrite Films and Applications to Rotation Rate Sensing

D.D. Stancil. "Theory of Magnetostatic Waves in Moving Ferrite Films and Applications to Rotation Rate Sensing." 1989 Transactions on Microwave Theory and Techniques 37.5 (May 1989 [T-MTT]): 851-859.

A first-order field theory for electromagnetic waves in moving ferrites and ferrite thin films is presented. The dominant effect of the motion is found to be the Doppler-shifted frequency observed in the moving frame. This gives rise to an anomalously large shift in wavenumber owing to the dispersive nature of the ferrite medium. Because of the large effect, it is suggested that a moving medium experiment using magnetostatic waves could be used to distinguish between various competing forms for the dispersion term in the Fresnel-Fizeau coefficient. The large Fresnel-Fizeau coefficient suggests that magnetostatic waves could be used to measure relative rotation rates if confined to propagate around the perimeter of a rotating disk. Since the phase drift would be established in the time required to propagate around the disk, the response time could be significantly shorter than conventional tachometers. An experiment with counterpropagating magnetostatic waves would clarify the effect of a magnetic medium on the magnitude of the Sagnac effect. Although it should be possible, in principle, to construct an absolute rotation rate sensor using magnetostatic waves (or more precisely, magnetic polaritons), the magnitude of the Sagnac effect is predicted to be the same as for ordinary electromagnetic waves with the saline frequency. Since the magnitude of the Sagnac phase shift is proportional to frequency, optical interferometers are still preferable.

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