

Abstract

Magnetostatic wave (MSW) devices have been introduced for signal processing in the microwave frequency range. The essential part of a MSW device is ferrimagnetic crystal through which the radio frequency signals propagate. However, prior to the implementation of MSW device, a thorough understanding and knowledge of the effect of material properties on propagation characteristics of MSW are essential.

Bandwidth, dispersion and propagation loss are the important figures of merit of any MSW device. The present work is the study of propagation characteristics of MSW in YIG film to quantify the effect of physical parameters on the dispersion, group delay and propagation loss. The complex wavenumber of magnetostatic wave propagating in single and multiple lossy ferrite layers backed by a metal layer is found by solving the dispersion equation using Davidenko's method for all principal modes of propagation of MSW. The real and imaginary parts of the wavenumber are used to obtain the dispersion, delay and propagation loss in case of different waveguiding structures. Further, the effect of finite conductivity of the metal on the characteristics of magnetostatic surface wave (MSSW), magnetostatic forward volume wave (MSFVW) and magnetostatic backward volume wave (MSBVW) propagation is discussed. The detailed steps for deriving the complex dispersion relation have been presented and the dependence of phase and attenuation constant on the thickness and conductivity of the metal layer is studied. Furthermore, the MSW propagation characteristics in finite width YIG sample with loss have also been examined and the deviations from the infinite width case have been underlined. Finally, a complete numerical approach based on finite difference method has been discussed. Results based on this method for the case finite width MSFVW propagation are compared with that available in the literature.