SYSTEMS APPLICATIONS OF MAGNETOSTATIC AND ACOUSTIC WAVE DEVICES

Paul H. Carr
James C. Sethares
Rome Air Development Center
Deputy for Electronic Technology
Hanscom Air Force Base, MA 01731

ABSTRACT

The applications and use of magnetostatic and acoustic wave signal processing devices in systems will be described. Magnetostatic wave and surface acoustic wave (SAW) technologies are complementary in that the frequency range of SAW devices is 10 MHz to 1 GHz, the traditional range of intermediate frequency processing, while that for magnetostatic devices is 1 to 15 GHz, the traditional microwave range.

A renaissance in planar magnetostatic devices has occurred due to the availability of inexpensive, high quality, narrow linewidth, thin YIG (Yttrium Iron Garnet) films, a spin-off from magnetic bubble memory technology. Rapidly tunable planar YIG film filters may, due to the advantages of planar technology, replace the YIG sphere filters presently used in many signal processing systems. Electronically tunable planar delay lines are feasible for direct signal processing applications at microwave frequencies. New grating transducers are under development for making planar transversal filters and resonators. Advances in magnetic synthesis techniques have made possible a bulk YIG time prism filter having a linear dispersive time delay of 0.5 μsec over a 2.5 to 4 GHz bandwidth. Such wide bandwidths are important for microscan receivers which perform rapid spectral analysis.

SAW devices are being used for intermediate frequency signal processing applications because of their small size and weight and relatively low cost. An analysis of 24 systems has revealed that pulse compression correlators are being used in 8 radar systems, bandpass filters are being used in 7 radar and communications systems, delay lines in 5 systems, fixed correlators in 3 airborne and ground radar systems, and a programmable correlator in the Joint Tactical Information Distribution System. SAW stabilized oscillators are being developed at frequencies up to 1.4 GHz, a frequency range of importance for the Global Positioning System.

Bulk overtone oscillators have the advantages of having a higher Q and being capable of operation to 10 GHz. Oscillators operating directly at microwave frequencies eliminate the multiplier chains required with conventional quartz oscillators.