Microwave Photonics Research at KRISS

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Extended Abstract

The Center for Electromagnetic Wave at KRISS (Korea Research Institute of Standards and Science) has conducted research in microwave photonics for the last eight years. The capability to measure microwave can be significantly enhanced when it is assisted with photonic technology. We, KRISS, have employed optical crystals - associated with laser systems - to overcome several challenges in relation to electromagnetic measurements. The crystals were utilized to build EO/MO (electrooptic/magnetooptic) probes to measure challenging electric/magnetic fields. The following topics are to be presented at the conference.

1. Minimally invasive field probe: The transparent nature of EO/MO probes for both electromagnetic and optical bands allows the realization of minimally invasive microwave field measurements. Field distribution images radiated within a wavelength region from electrical devices are presented.

2. High-intensity field measurements: The all-dielectric embodiment of optical probes enables us to sense very intense electric fields up to the MV/m scale. Our EO probes show a dynamic range which exceeds 100 dB with good linearity. The capability of intense field measurements using a high-power gyrotron, a plasma source, an MRI system, and a 50 kV AC voltage supply is presented.

3. Millimeter-wave measurements: A photonic-based sensing scheme is also a clear advantage given that it enhances the sensing bandwidth by extending it to the mm-wave band. We devised sub-mm scale EO probes for mm-wave sensing to minimize invasiveness. The stability of the EO probe system was also improved by compensating any system drift with multiple probes. Stabilized sensing results for various W-band devices are presented.

4. Fast pulse scoping system: Rapid electrical pulses can be measured using an ultrafast laser. We have built a pump-probe time-domain sensing scheme to sample 100 GHz pulses from a laser-driven photodiode. The detailed sensing technique is presented and the results are discussed.

5. Highly sensitive field probes: The sensitivity of the EO probes can be greatly improved when the electrodes are assisted. We have fabricated a folded Mach-Zehnder type of optical waveguide on an EO wafer. With free-space electrodes which serve as a dipole antenna along the waveguide, the EO wafer works as an effective field probe at the bandwidth of the electrodes. The enhanced performance of such integrated optic probes is presented.

References

References are to be given during the presentation.