Electro-optic probe based on integrated optical waveguide

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Extended Abstract

The capability to measure microwave can be significantly enhanced when it is assisted with photonic technology. Electro-optic (EO) probing is one of the major microwave photonics techniques to overcome several challenges in relation to electromagnetic measurements. The inherently transparent nature of EO probes for both electromagnetic and optical bands allows the realization of minimally invasive microwave field measurements. Despite of the lower invasiveness compared with conventional microwave probes, the low sensitivity of EO probes has been the main huddle to be an attractive sensing solution.

To address this issue, we have developed highly sensitive EO probes. The sensitivity of the EO probes can be greatly improved when metallic electrodes are assisted on optical waveguide. We have fabricated a folded Mach-Zehnder type of optical waveguide on an x-cut Lithium Niobate substrate. 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.

We also have developed a compact EO probing system to operate the EO probes. The system is made of all-fiber optics from a built-in laser to photoreceiver. Then, the probes - associated with the probing system - are calibrated using a field-calculable open TEM cell. The calibrated results show that such integrated optic probes provide enhanced performance in terms of dynamic range, linearity, bandwidth, and spatial resolution.

We used these EO probes to measure phase-arrayed antenna set (4 x 1 at 28 GHz) and micro transmission line (30 μm linewidth) analysis. The detailed specification of the probing system and application examples are to be presented at the conference.

References

References are to be given during the presentation.