Inductance-tuned Electro-optic Modulators
Technology #16370

Applications
- Fiber-optic telecommunications
- Photonic signal processing
- Electro-optic applications
- Digital computation systems

Problem Addressed
Electro-optic modulators take voltage variations in an electrical signal and transforms them into variations in the intensity and wavelength of light transmitted by an electro-optic material. Electro-optic modulators are becoming increasingly important in electronics and are constructed from microwave transmission lines adjacent to optical waveguides. For optimum system performance, the microwave and optical waves must travel at the same velocity, although traditionally, microwaves move through transmission lines faster than optical waves travel though waveguides. Current solutions include slowing the microwave wave velocity, which causes optical losses, reduced bandwidth and mismatched conditions from lowered microwave impedance.

Technology
The technology is a 100-GHz modulator that can handle optical power greater than 100 mW. Using inductance tuning of the modulator transmission lines allows the matching of the optical and electrical velocities. The method keeps the characteristic system impedance at the optimal 50 ohms level, while allowing the length of the optical waveguide and transmission lines to be minimized. This ensures that the optical losses in the modulator are minimized. In addition, the waveguide, materials and fabrication process are specifically designed to reduce optical losses, while maintaining mode flexibility. Through decoupling the inductance and the capacitance of the microwave lines, a modulator was invented which minimizes the device length, optimizes the microwave transmission impedance and minimizes the optical losses.

Advantages
- Microwave transmission impedance maintained at the optimal 50 ohms
- Device length and optical losses are minimized
- Adaptable to a variety of optical modes
- Decouples transmission line inductance and capacitance

Categories For This Invention:
Electronics & Circuits
Electronic Components
Energy
Induction
Lincoln Laboratory
Photonics
Other (Photonics)

**Intellectual Property:**

Inductance-tuned electro-optic modulators
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**Publications:**

*Ultra Wide Bandwidth Electro-Optic Intensity Modulators with 0.46 V-cm Modulation Efficiency at 1550 nm*
2014 IEEE Photonics Conference
October 12, 2014

*Development of Electro-Optic Phase Modulator for 94 GHz Imaging System*
Journal of Lightwave Technology
2009

**External Links:**

Lincoln Laboratory
http://www.ll.mit.edu/

**Image Gallery:**

![Image of modulator](image-url)