論　文　要　旨
Thesis Abstract

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主論文題名　(Title)

Modular design concept of electro-optical waveguides and adaptor for ferrule to waveguide coupling

内容の要旨　(Abstract)

This research introduces the feasibility of implementing the modular concept in the Electro-Optical (EO) waveguide device. The design objective is to improve the customizability and availability and simplify the fabrication. This research is focusing on the post-customization limitation of the EO waveguide device and the complicated fiber-to-waveguide coupling. These two problems are caused by the nature of the EO waveguide design and the fabrication procedure.

For the most part, the electrode was embedded in the waveguide's metal layer using an integrated electrode design in the commonly used EO waveguide. The lack of the ability to customize the electrode and waveguide structure after fabrication is an unfortunate limitation of this design. An approach for implementing the modular design concept in the EO waveguide was proposed by this research. The device is separated into three major components: the electrode, the EO waveguide, and the retention unit. This devices improve the fabrication's simplicity and allow customization in post-fabrication. The operational wavelength range of the proposed Long-Period Grating (LPG) EO waveguide is 1510-1531 nm.with the ability to post-customize it to operate at 1466-1483 nm.The proposed device can be fabricated with less complicated machinery and could be done in parallel.

To solve the common coupling problem that every thin film waveguide is facing and become more severe due to the modular changeable part, this research also proposed a coupling solution that can change the fiber or waveguide without any specialized tool required, and most of the components can be printed by Digital Light Processing (DLP) printers without any support structure required. The standard FC connector was selected as the fiber interface in the proposed design, while the exponential concave taper structure was implemented as the waveguide interface. The Finite-Difference Time-Domain (FDTD) was used to simulate the suggested design with alignment offset for the parallel misalignment and angular offset for angular misalignment.

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