

Customization Process for New Optical Directional Couplers for Distribution Network Automation



AI Overview

The customization of optical directional couplers involves parametric modeling, simulation-based optimization, fabrication-tolerant design, and integration into programmable photonic networks.

Parametric Modeling and Simulation The first step in customizing a directional coupler is to create a parametric model that captures the key performance characteristics, such as coupling ratio and wavelength dependence. Tools like IPKISS and Ansys Lumerical FDTD allow designers to define a PCell (parameterized cell) for the coupler, simulate its behavior, and perform polynomial fitting to generate a model based on parameters like wavelength and straight waveguide length. This approach enables rapid iteration and optimization before fabrication. Simulation platforms such as VPItransmissionMaker Optical Systems provide a virtual prototyping environment for testing coupler designs within complex network scenarios, including bidirectional links and automated distribution networks. These tools allow designers to perform “what-if” analyses, optimize component specifications, and benchmark performance under different operational conditions.

Fabrication-Tolerant Design Directional couplers are highly sensitive to fabrication errors, particularly variations in waveguide width or spacing. A fabrication-tolerant design ensures that the coupler maintains a uniform coupling ratio across the operating wavelength (e.g., 1550 nm) despite these variations. Techniques include: Optimizing the waveguide geometry to reduce sensitivity to width deviations. Using broadband designs to maintain consistent performance across a range of wavelengths. Simulating the effects of fabrication errors using finite-differe...

Article Content

Flame-fused Optical Fiber Directional Couplers: Fabrication and ...

A microprocessor controlled system for fabrication of 2 x 2 flame-fused biconical single-mode fiber directional couplers has been designed and realised. The system involves multiple

Working Principle and Application of Fiber Directional

Fiber directional coupler is an optical device that can realize the distribution and combination between different optical fibers. It is made of optical fiber and has a

Rational design of an integrated directional coupler for

We consider a design procedure for directional couplers for which the coupling length is approximately wavelength-independent over a wide

Implementation of all-optical 3-dB and 10-dB directional coupler for ...

Directional couplers (DC) are made up of two optical waveguides that are brought close enough together to interact optically in their respective modes. This interaction separates the modes

A fixed phase tunable directional coupler based on coupling tuning

Due to the inability of conventional tunable directional couplers (TDCs) to maintain a fixed phase while tuning the reflectivity, Mach-Zehnder interferometers (MZIs) are employed as the primary ...

Directional Coupler

A directional coupler is defined as a device that couples only to waves traveling in a specific direction, allowing for the measurement of forward and reverse power levels in transmission

Introduction to the Directional Coupler for RF Applications

Introduction to the Directional Coupler for RF Applications As part of a vector network analyzer (VNA), a directional coupler enables us to characterize

Optical Fiber Directional Coupler Insights

The document discusses optical directional couplers, which are fiber optic devices that combine or split an optical signal between two fiber ports. It describes how directional couplers work using the

Chapter 5 The Optical Directional Coupler

Abstract This chapter presents a detailed discussion of optical directional couplers, which is one of the important components of integrated quantum photonic circuits. Coupled mode theory is used to

Optical Coupler

An optical directional coupler is one of the most basic inline fiber-optic components, often used to split and combine optical signals, or tap-off a small portion of the optical power for monitoring.

Directional coupler and multimode interference devices based on SiN:

Since the evanescent field is the underlying principle of waveguide coupling and is critical for the performance of directional coupler devices, we investigated the impact of refractive index

All-optical switching in epsilon-near-zero asymmetric directional ...

Abstract We propose an all-optical switch based on an asymmetric directional coupler structure with epsilon-near-zero (ENZ) layer.

Methodology for Fabrication-Tolerant Planar Directional Couplers

Abstract: A new methodology for realizing fabrication-tolerant planar directional couplers is proposed and experimentally demonstrated.

Ultra-Broadband, Fabrication Tolerant Optical Coupler for Arbitrary ...

Abstract: This work presents a design approach of multi-segment directional couplers with ultra-broadband flat spectra and benign fabrication tolerance on the silicon nitride platform.

Tunable Directional Couplers for High Contrast Optical Meshes

We describe the operation, design, and fabrication of MEMS-tunable silicon-photonics directional couplers, with potential for smaller footprint, less sensitivity to fabrication errors, and

Rational design of an integrated directional coupler for wideband

We show analytically that two coupled planar waveguides exhibit a maximum in the coupling strength, which ensures both wideband transmission and minimal device footprint.

Next-generation high-performance complex optical sequential circuits ...

The concept of optical switching utilizing directional couplers and the electro-optic effect has been leveraged to design various sequential circuits. By applying an appropriate voltage to the

Fiber Directional Coupler

Fused fiber directional couplers are easier to fabricate compared to many other optical devices, and their fabrication can be automated by online monitoring of input and output optical powers from different

Design and Characterization of Fiber Optic Directional Couplers

This paper describes the design principles of a fiber-optic directional coupler, including the intracellular photoelectric field equations, field amplitude equations, and propagation constants derived from

Design of All-Optical Directional Coupler Using Plasmonic ...

The proposed 10-dB directional coupler and 3-dB directional coupler feature good energy confinement, ultra-compact, and low propagation loss, which has potential applications in photonic integrated

Broadband Silicon-On-Insulator directional couplers using a ...

Broadband Silicon-On-Insulator (SOI) directional couplers are designed based on a combination of curved and straight coupled waveguide sections.

Optical Directional Couplers and their Applications

Optical directional couplers (ODCs) consist of two or more closely-located optical waveguides, whose modes can couple evanescently and thereby exchange their powers, realizing,

A fixed phase tunable directional coupler based on coupling tuning

In this study, we introduce a design of a TDC based on coupling constant tuning in the thin film Lithium Niobate platform and present an optimized design.

Design and Implementation of a Last-Mile Optical

Following this trend, many power companies have installed optical communication lines for their last mile network, called fiber to the pole, along

Highly efficient and selective integrated directional couplers for ...

A compact directional coupler structure-based duplexer has been investigated, provided with the higher output power coupling ratio for combining wavelengths equal to 1530 nm and 1653.7 nm.

The Ultimate Guide to Directional Coupler Design

Design Considerations for Directional Couplers Before diving into the design process, it's essential to understand the key considerations that will impact the performance of your directional

Designing Smarter Directional Couplers with Parametric

Learn how to leverage IPKISS to optimize the design of directional couplers and implement advanced parametric modeling. Introduction A directional coupler

Optical Directional Couplers | Springer Nature Link

The optical directional coupler, analogous to the microwave element¹ of the same name, consists of parallel channel optical waveguides sufficiently closely spaced that energy is transferred from one to

Design and Optimization of Broadband Directional Couplers and

This paper introduces a streamlined design that includes a broadband directional coupler, a set of three-port union-T power dividers, and several microstrip transitions. These

Design and fabrication of optical waveguide as directional coupler ...

In this study using CO₂ laser cutting to create a directional coupler channel. In the process of making the canal done with engraving on acrylic substrate with 4.2 mW laser power and

Contact Us

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