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Integrirana optika - Slovar - 1. del: Osnovni strokovni izrazi in simboli (ISO/DIS 11807-1:2020)

Integrated optics - Vocabulary - Part 1: Optical waveguide basic terms and symbols (ISO/DIS 11807-1:2020)

Integrierte Optik - Begriffe - Teil 1: Grundbegriffe und Formelzeichen (ISO/DIS 11807-1:2020)

Optique intégrée - Vocabulaire - Partie 1: Termes fondamentaux et symboles des guides d'onde optique (ISO/DIS 11807-1:2020)

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Integrated optics — Vocabulary —

Part 1: **Optical waveguide basic terms and symbols**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 172 *Optics and photonics*, Subcommittee SC 9, *Laser and electro optical systems*.

This second edition cancels and replaces the first edition (ISO 11807-1:2001), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Terminologies that have not been frequently used over the last 5 to 10 years are revised to those matching to current trends.

— In the revision process, terminologies and definitions are compared to similar terminology definitions in IEC and harmonized.

A list of all parts of ISO 11807 can be found on the ISO Website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html .

Introduction

The aim of this part of ISO 11807 is to clarify the terms of the relatively new field of "integrated optics" and to define a unified vocabulary at a time when the first products are coming onto the market. It is expected that this part of ISO 11807 will be revised periodically to adopt the requirements of customers and suppliers of integrated optical products. At a later stage, it is planned to add definitions from other International Standards which deal with integrated optics.

Some of the definitions are closely related to definitions given in IEC 60050, *International electrotechnical vocabulary*. Wherever this can lead to misunderstanding, integrated optics or integrated optical waveguide should be used together with the defined term.

Integrated optics — Vocabulary —

Part 1:
Optical waveguide basic terms and symbols

1 Scope

This document defines basic terms for integrated optical devices, their related optical chips and optical elements which find applications, for example, in the fields of optical communications and sensors.

— The coordinate system used in Clause 3 is described in Annex A.

— The symbols and units defined in detail in Clause 3 are listed in Table B.1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11807-2, *Integrated optics -- Vocabulary -- Part 2: Terms used in classification*

ISO 14881, *Integrated optics -- Interfaces -- Parameters relevant to coupling properties*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11807-2 and ISO 14881 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1 General

3.1.1
integrated optics
planar optical waveguide structures, manufactured either in or on a substrate, including the optical components necessary for the input and output coupling of lightwaves

Note 1 to entry: In this context the term "planar" is used to include small deviations from planarity such as are incurred with, for example, Luneburg lenses. By use of a suitable material, it is possible to integrate both optoelectronic and purely optical functions on the same substrate. The simplest case is electrodes, which can be used for controlling the properties of a waveguide. It is, however, possible to fabricate lasers and detectors using compound semiconductor materials.

Note 2 to entry: It is envisaged that integrated optical components will be combined with other microtechnologies, such as microelectronics and micromechanics, to make more complex systems. However, such systems are beyond the scope of this part of ISO 11807, which will be concerned only with the integrated optical component and its immediate interfaces (see IEC 60050-731/06-43).

3.2 Waveguide structures

3.2.1
waveguide
transmission line designed to guide optical power consisting of structures which guide lightwaves on the basis of a higher refractive index in the core and a lower index of refraction in the surrounding material

Note 1 to entry: The lightwaves in a waveguide propagate in modes.

3.2.2
slab waveguide
planar waveguide
waveguide which confines the optical field in rectangular crosssection along a parallel extended light guiding surface or between two such surfaces

Note 1 to entry: See **Figure A.1** where the Cartesian coordinate system is indicated for defining the several terminologies relating to waveguides.

3.2.3
strip waveguide
channel waveguide
waveguide which confines the optical field in a two-dimensional cross-sectional area perpendicular to the lightwave propagating direction (wavenumber vector) along a one-dimensional path

3.2.4
core
the region(s) of an integrated optical waveguide, in which the optical power is mainly confined

3.2.5
cladding
material surrounding the waveguide core

Note 1 to entry: In contrast to optical fibres for integrated optical waveguides, the cladding often consists of more than one material. Normally, it is necessary to distinguish between lower cladding and upper cladding due to the planar fabrication process of integrated optical waveguides.

3.2.6
substrate
carrier onto or within which the integrated optical waveguide is fabricated

3.2.7
superstrate
medium or layer structure with which the integrated optical waveguide is covered

Note 1 to entry: An electrode, for example, should not be designated as a superstrate. Although it covers the waveguide, it would not influence the optical properties of the waveguide due to an optically insulating layer of sufficient thickness.

3.3 Modes in integrated optical waveguides

3.3.1
mode
eigenfunction of Maxwell's equations, representing an electromagnetic field in a certain space domain and belonging to a family of independent solutions defined by specific boundary conditions

Note 1 to entry: Each mode is defined according to its order in the vertical and horizontal directions and its polarization, the latter being separated into TE- and TM-modes. The mode order is given by indexing TE_{ij} and TM_{ij}, where TE and TM represent respectively the *y*- and *x*-direction of polarization, and *i* and *j* define the mode indices (the order) along *x* (horizontal) and *y* (vertical) respectively.

3.3.2
guided mode
electromagnetic wave whose electric field decays monotonically in the transverse direction everywhere external to the core and which does not lose power

3.3.3
TE mode
transverse electromagnetic wave, where the electric field vector is normal to the direction of propagation; i.e., the electric field vector lies in the transverse plane (*xy*-plane).

Note 1 to entry: Strictly speaking, in strip waveguides, hybrid modes having the non-zero component of the electric and magnetic field in the direction of propagation do exist. Pure TE- and TM-waves are only found in waveguides with a corresponding geometry — for example in slab waveguides. For integrated optical waveguides in planar substrates, it is natural to define the polarization state relative to the substrate surface. Because the terms TE and TM are used and well understood in general language in the context of planar waveguides, they are also applied in the same sense to strip waveguides.

Note 2 to entry: In planar waveguides, the electric field vector of TE mode lies in the *y* direction, as a result of the definition.

3.3.4
TM mode
transverse electromagnetic wave, where the magnetic field vector is normal to the direction of propagation; i.e., the magnetic field vector lies in the transverse plane (*xy*-plane).

Note 1 to entry: In planar waveguides, the magnetic field vector of TM mode lies in the **y** direction, as a result of the definition.

3.3.5
evanescent field
time varying electromagnetic field in an integrated optical waveguide whose field amplitude decays very rapidly and monotonically in the transverse direction outside the core, but without an accompanying phase shift

3.3.6
leaky mode
mode having an evanescent field in the transverse direction external to the core for a finite distance but with an oscillating field in the transverse direction everywhere beyond that distance

Note 1 to entry: A leaky mode is attenuated due to radiation losses along the waveguide.

3.3.7
radiation mode
mode which transfers power in the transverse direction everywhere external to the core

3.3.8
single-mode waveguide
waveguide which guides only one mode order

Note 1 to entry: The waveguide mode may consist of two orthogonal states of polarization.

3.3.9
multimode waveguide
waveguide which supports more than one guided mode

3.3.10
waveguide cutoff
transition of a guided mode at which the propagation changes from being guided to being leaky or radiative