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Optics and photonics - Diffractive optics - Vocabulary (ISO/FDIS 15902:2019)

Optik und Photonik - Difraktive Optik - Begriffe (ISO/FDIS 15902:2019)

Optique et photonique - Optique diffractive - Vocabulaire (ISO/FDIS 15902:2019)

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ISO/FDIS 15902:2019(E)

Foreword

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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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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 15902:2004), of which it constitutes a minor revision. It also incorporates the Technical Corrigendum ISO 15902:2004/Cor 1:2005.

The changes compared to the previous edition are as follows:

- in [3.3.3.4](#), an explanation on the factor has been added in a note to entry;
- in [3.4.3.4](#), the sign has been corrected;
- other editorial changes have been made.

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 term diffractive optical element is used for those optical elements which convert an input wavefront to a predetermined output wavefront (or wavefronts) in free space by means of the phenomenon of diffraction. There has been a rapid increase in the use of diffractive optical elements, especially in the field of optical data storage, and they are essential components in optical and electro-optical systems. They are used in a wide variety of applications.

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Optics and photonics — Diffractive optics — Vocabulary

1 Scope

This document defines the basic terms for diffractive optical elements for free space propagation. The purpose of this document is to provide an agreed-upon common terminology that reduces ambiguity and misunderstanding and thereby aid in the development of the field of diffractive optics.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 Diffractive optics technologies

3.1.1

diffractive optics

optical technology based on the phenomenon of the diffraction of optical radiation

3.1.2

binary optics

diffractive optics technology whose optical components have a quantized surface structure in height

Note 1 to entry: See [3.3.2.8](#) and [3.3.2.9](#).

Note 2 to entry: The word binary originally means a two-step structure in cross section, however, a staircase structure in cross section is usually referred to as binary as well, regardless of the number of the steps. This incorrect wording originates from the fact that these structures are fabricated using a mask lithography technique.

3.1.3

holographic optics

diffractive optics technology that uses holograms as optical elements for transforming an incident wavefront into a specific wavefront or wavefronts

3.2 Diffractive optical elements and their types

3.2.1

diffractive optical element

DOE

optical element for which the phenomenon of the diffraction of optical radiation is the operating principle, usually characterized in terms of its periodic spatial structure

3.2.2

amplitude diffractive optical element

optical element which utilizes the diffraction created by its periodic spatial amplitude modulation

ISO/FDIS 15902:2019(E)**3.2.3****phase diffractive optical element**

optical element which utilizes the diffraction created by its periodic spatial phase modulation

3.2.4**transmission diffractive optical element**

diffractive optical element that operates with transmitted optical radiation

3.2.5**reflection diffractive optical element**

diffractive optical element that operates with reflected optical radiation

3.2.6**active diffractive optical element**

diffractive optical element whose diffraction characteristics can be dynamically changed

3.2.7**holographic optical element****HOE**

diffractive optical element fabricated with an interferometric method

3.2.8**computer-generated diffractive optical element**

computer-generated hologram (CGH)

diffractive optical element which is computer-designed and fabricated under computer control

Note 1 to entry: A computer-generated diffractive optical element is generally fabricated using a mechanical method or by lithography, using optical radiation waves (including laser beams), electron beams or ion beams, and is often referred to as a "computer-generated hologram (CGH)".

3.2.9**binary optical element****BOE**

phase-diffractive optical element having a binary-level or quantized multi-level surface-relief structure

Note 1 to entry: See Note 2 to entry in [3.1.2](#).

3.3 Structure of diffractive optical elements**3.3.1 General structure****3.3.1.1****substrate for diffractive optical elements**

basic body of the diffractive optical element

Note 1 to entry: It may support the element's periodic structure on its surface, or it may contain that periodic structure within itself.

3.3.1.2**grating**

periodic spatial structure for optical use

3.3.2 Phase structure**3.3.2.1****phase profile**

phase distribution of a diffractive optical element, which is added to incident optical radiation

3.3.2.2**surface relief diffractive optical element**

optical element whose diffractive property is created by a periodic relief pattern deposited on or corrugated in the substrate

3.3.2.3**Q-factor**

Q-value

for a periodic structure with a sinusoidal refractive-index profile, this is given by

$$Q = \frac{2\pi\lambda T}{n_{\text{av}}\Lambda^2}$$

Note 1 to entry: The value is used to categorize gratings as either thick or thin. It should be noted that it is defined only for sinusoidal refractive index profile.

3.3.2.4**thin diffractive optical element**

diffractive optical element which produces Raman-Nath diffraction

Note 1 to entry: For a diffractive optical element with a sinusoidal refractive index profile, it is characterized by $Q < 1$.

3.3.2.5**thick diffractive optical element**

diffractive optical element which produces Bragg diffraction

Note 1 to entry: For a diffractive optical element with a sinusoidal refractive index profile, it is characterized by $Q \gg 1$.

3.3.2.6**volume phase diffractive optical element**

thick diffractive optical element whose diffraction is created by a three-dimensional periodic refractive index distribution within the substrate

3.3.2.7**phase step**

stair step

step in binary phase structure

3.3.2.8**binary phase structure**

discrete phase structure that may have either simple binary or quantized phase steps

Note 1 to entry: See Notes to entry to [3.1.2](#) and [3.3.2.9](#).

3.3.2.9**multi-level phase structure**

binary phase structure that has more than two phase levels in one period

Note 1 to entry: Multi-level phase structure includes binary phase structure in its definition, however, each term is sometimes used as a synonym of the other.

Note 2 to entry: See Note 2 to entry to [3.1.2](#).

3.3.2.10**blazed diffractive optical element**

surface relief diffractive optical element able to concentrate the diffracted light energy in a specified diffraction order or orders using a prismatic structure in one period