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Optics and photonics – Measurement method of semiconductor lasers for sensing

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Foreword

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The committee responsible for this document is ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

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Optics and photonics — Measurement method of semiconductor lasers for sensing

1 Scope

This Technical Specification describes methods of measuring temperature, injected current dependence and lasing spectral line width in relation to semiconductor lasers for sensing applications. This Technical Specification is applicable to all kinds of semiconductor lasers, such as edge-emitting type and vertical cavity surface emitting type lasers, bulk-type and (strained) quantum well lasers, and quantum cascade lasers, used for optical sensing in e.g. industrial, medical and agricultural fields. This Technical Specification is an application of ISO 13695, in which the physical bases are explained.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13695, *Optics and photonics — Lasers and laser-related equipment — Test methods for the spectral characteristics of lasers*

3 Optical sensing using semiconductor lasers

3.1 General

The methods described in this Technical Specification are to be followed in accordance with ISO 13695.

Optical sensing using tunable semiconductor laser spectroscopy has been widely used in various engineering fields. For example, optical sensing is being used for bio-sensing and environmental monitoring. Semiconductor lasers are key devices for those applications and are indispensable for building sensing equipment. Semiconductor lasers and sensing techniques are described in 3.2 to 3.6.

3.2 Semiconductor laser

3.2.1 General

A semiconductor laser is an optical semiconductor device that emits coherent optical radiation in a certain direction through stimulated emission resulting from electron transition when excited by an electric current that exceeds the threshold current of the semiconductor laser. Here, the mechanism of coherent optical radiation is divided into two categories, (1) electron-hole recombination due to interband electron transition between conduction and valence band (bulk type) or between two quantized states (quantum well type, see 3.2.5) and (2) intraband electron transition between two quantized states (quantum cascade type, see 3.2.5).

Edge-emitting types with single lasing modes, such as distributed feedback (DFB) lasers, have been conventionally used in sensing equipment because of their high power and single lasing modes. Surface-emitting types are also widely used in sensing systems because they are easy to handle. Some names are given to those lasers from various aspects. Those lasers are briefly categorized in 3.2.2 to 3.2.5.

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