SLOVENSKI STANDARD
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Geometrical product specifications (GPS) - Surface texture: Areal - Part 604: Design and characteristics of non-contact (coherence scanning interferometry) instruments (ISO/DIS 25178-604:2023)

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ICS:

17.040.20	Lastnosti površin	Properties of surfaces
17.040.40	Specifikacija geometrijskih veličin izdelka (GPS)	Geometrical Product Specification (GPS)

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Geometrical product specifications (GPS) — Surface texture: Areal —

Part 604:
Design and characteristics of non-contact (coherence scanning interferometry) instruments

ICS: 17.040.20

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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.

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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.

The committee responsible for this document is Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

This second edition cancels and replaces the first edition (ISO 25178-604:2013), which has been technically revised.

A list of all parts in the ISO 25178 series can be found on the ISO website.

Introduction

This document is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO 14638). It influences chain link F of the chains of standards on profile and areal surface texture.

The ISO GPS matrix model given in ISO 14638 gives an overview of the ISO GPS system of which this document is a part. The fundamental rules of ISO GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to the specifications made in accordance with this document, unless otherwise indicated.

For more detailed information of the relation of this document to other standards and the GPS matrix model, see Annex C.

This document includes normative terms and definitions relevant to the coherence scanning interferometry (CSI) method for the measurement of areal surface topography. The informative Annex A briefly summarizes CSI instruments and methods to clarify the normative definitions and to provide a foundation for informative Annex B, which describes common sources of uncertainty and their relation to the metrological characteristics of CSI.

NOTE Portions of this document, particularly the informative sections, describe patented systems and methods. This information is provided only to assist users in understanding the operating principles of coherence scanning interferometric microscopy. This document is not intended to establish priority for any intellectual property, nor does it imply a license to proprietary technologies described herein.

Geometrical product specifications (GPS) — Surface texture: Areal —

Part 604: Design and characteristics of non-contact (coherence scanning interferometry) instruments

1 Scope

This document describes the design and metrological characteristics of coherence scanning interferometry systems for areal measurement of surface topography. Because surface profiles can be extracted from surface topography data, the methods described in this document can be applied to profiling measurements as well.

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 25178-600:2019, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 600: Metrological characteristics for areal topography measuring methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 25178-600 and the following apply.

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

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

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

3.1
coherence scanning interferometry
CSI
surface topography measurement method wherein the localization of interference fringes during a scan of optical path length provides a means to determine a surface topography map

[SOURCE: ISO 25178-6:2010, 3.3.5]

Note 1 to entry: The optical path length difference is the difference in optical path length, including the effect of geometry and refractive index, between the measurement and reference paths of an interferometer (ISO 10934-1:2020, 3.1.83).

Note 2 to entry: CSI uses a broad illumination spectral bandwidth, the illumination geometry, or both, to localize the interference fringes.

Note 3 to entry: CSI uses either fringe localization alone or in combination with interference phase evaluation, depending on the surface type, desired surface topography repeatability and software capabilities.

Note 4 to entry: Table 1 provides a list of alternative terms for CSI that are in part within the scope of this document.

Table 1 — Summary of common alternative terms for CSI

Term	Bibliography
Coherence probe microscopy Coherence radar Coherence correlation interferometry	[9-14]
White light interferometry White light scanning interferometry Scanning white light interferometry	[15-17]
Vertical scanning interferometry Height scanning interferometry	[18,19]
Full-field optical coherence tomography	[20]

3.2
coherence scanning interferometry scan
CSI scan
mechanical or optical scan which varies the optical length of either the reference path or measurement path to vary the optical path difference.

Note 1 to entry: The imaging optics is nominally parallel to the axial scan axis of the microscope.

Note 2 to entry: A CSI signal can correspond to a sequence of electronic camera detections of intensity values during a CSI scan (see Annex A).

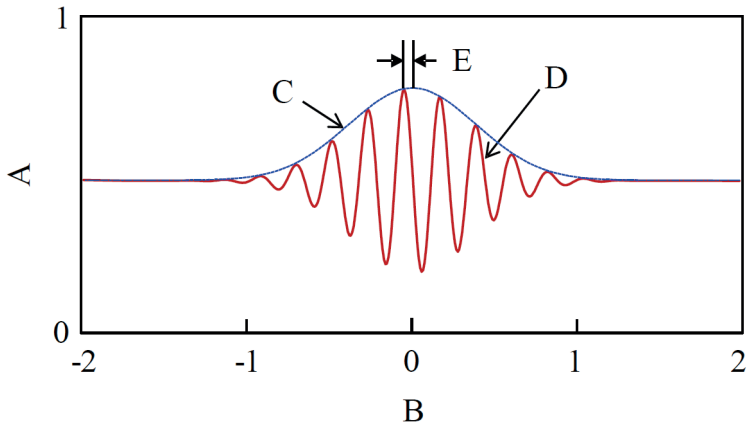
Note 3 to entry: In CSI, the most common (but not exclusive) scanning means is a physical adjustment of the path length of an interferometer (ISO/TR 14999-2:2019), which shall be pre-adjusted such that the peak CSI signal modulation amplitude coincides with the position of best focus.

Note 4 to entry: Mechanical means for performing the CSI scan can be motorized or piezo-electrically driven stages or others, depending on the instrument design, the linearity and consistency of the CSI scan, or the desired maximum CSI scan length.

3.3
coherence scanning interferometry signal
CSI signal
intensity data recorded for an individual image point or camera pixel as a function of *CSI scan* (3.2) position

Note 1 to entry: The CSI signal is sometimes referred to as the correlogram or the white light interferometry signal.

Note 2 to entry: See Figure 1 for a simulated example CSI signal for an *equivalent wavelength* (3.12) of 450 nm and a measurement optical bandwidth of 110 nm at full width half maximum (ISO 25178-600:2019, 3.3.2) and a low illumination numerical aperture (ISO 10934:2020, 3.1.10.4; ISO 25178-600:2019, 3.3.6).



Key

A	intensity	D	interference fringes
B	CSI scan position expressed in micrometres	E	phase Gap
C	modulation envelope (calculated)		

Figure 1 — Defined features of a CSI signal

3.4
coherence scanning interferometry scan increment
CSI scan increment
distance travelled by the *CSI scan* (3.2) between data captures

Note 1 to entry: A data capture can be a single image point or a camera frame.

Note 2 to entry: The CSI scan increment is most often small enough to sample each interference fringe at several points, for example 4 camera frames per fringe, consistent with the Nyquist criterion. Sub-Nyquist sampling is also possible for higher data acquisition speeds, at the cost of higher measurement noise.

3.5
coherence scanning interferometry scan length
CSI scan length
total range of physical path length traversed by the *CSI scan* (3.2)

Note 1 to entry: The CSI scan length should normally be sufficiently long so as to capture the desired surface topography range plus at least a portion of the modulation envelope width.

3.6
coherence scanning interferometry scanning rate
CSI scanning rate
speed at which the *CSI scan* (3.2) is executed

Note 1 to entry: For a linear *CSI scan* (3.2), the CSI scanning rate is the camera framerate multiplied by the CSI scan increment.

Note 2 to entry: An equivalent term is CSI scan speed.

3.7
interference fringes
<CSI> modulating portion of the *CSI signal* (3.3), related to the interference effect and generated by the variation of optical path length during the *CSI scan* (3.3)

Note 1 to entry: The interference fringes are approximately sinusoidal as a function of scan position.

Note 2 to entry: See Figure 1 for an illustration of the interference fringes of a CSI signal.