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Specifikacije geometrijskih veličin izdelka (GPS) - Filtriranje - 31. del: Robustni filtrni profil: Gaussovi regresijski filtri (ISO/DIS 16610-31:2023)

Geometrical product specifications (GPS) - Filtration - Part 31: Robust profile filters: Gaussian regression filters (ISO/DIS 16610-31:2023)

Geometrische Produktspezifikation (GPS) - Filterung - Teil 31: Robuste Profilfilter: Gaußsche Regressionsfilter (ISO/DIS 16610-31:2023)

Spécification géométrique des produits (GPS) - Filtrage - Partie 31: Filtres de profil robustes: Filtres de régression gaussiens (ISO/DIS 16610-31:2023)

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Geometrical product specifications (GPS) — Filtration —

Part 31:
Robust profile filters: Gaussian regression filters

Spécification géométrique des produits (GPS) — Filtrage —

Partie 31: Filtres de profil robustes: Filtres de régression gaussiens

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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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 290, *Dimensional and geometrical product specification and verification*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This edition of ISO 16610-31 cancels and replaces ISO 16610-31:2016, which has been technically revised.

The main changes are as follows:

— This document defines ideal continuous Gaussian regression filters for open profiles and for closed profiles, exemplary applied to roundness profiles.

— A normative iterative solution for the ideal continuous Gaussian regression filter is given.

A list of all parts in the ISO 16610 series 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

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 C of all chains of standards.

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 information on the relationship of this document to filtration matrix model, see Annex C.

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

This document develops the terminology and a concept of robust Gaussian regression filters for profiles. It separates the large and small lateral scale components of a surface profile in such a way that the surface profile can be reconstructed without altering. The robust Gaussian regression filter for profiles reduces the influence of protruding dales and hills.

Geometrical product specifications (GPS) — Filtration —

Part 31:
Robust profile filters: Gaussian regression filters

1 Scope

This document specifies robust Gaussian regression filters for the filtration of surface profiles. It defines, in particular, how to separate large and small lateral scale components of a surface profile with protruding dales and hills.

The concepts presented for closed profiles are applicable to the case of roundness filtering. Where appropriate, these concepts can be extended to generalized closed profiles, especially for profiles with re-entrant features.

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 16610-1:2015, *Geometrical product specifications (GPS) — Filtration — Part 1: Overview and basic concepts*

ISO 16610-20:2015, *Geometrical product specifications (GPS) — Filtration — Part 20: Linear profile filters: Basic concepts*

ISO 16610-21, *Geometrical product specifications (GPS) — Filtration — Part 21: Linear profile filters: Gaussian filters*

ISO 16610-30:2015, *Geometrical product specifications (GPS) — Filtration — Part 30: Robust profile filters: Basic concepts*

ISO/IEC Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16610-1, ISO 16610-20, ISO 16610-21, ISO 16610-30, ISO/IEC Guide 99, and the following apply.

ISO and IEC maintain terminology 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
surface profile
line resulting from the intersection between a surface portion and an ideal plane

[SOURCE: ISO 16610-1:2015, 3.1.2, modified — Note 1 to entry and Note 2 to entry removed.]

3.1.1
open profile
surface profile with finite length and two ends

Note 1 to entry: The surface profile does not intersect with itself.

Note 2 to entry: An open profile has a compact support, i.e., within a certain interval the height values of an open profile can be any real number. Outside the interval the height values of an open profile are zero.

[SOURCE: ISO 16610-1:2015, 3.7, modified — Note 2 to entry added.]

3.1.2
closed profile
connected finite length surface profile without ends

Note 1 to entry: The surface profile does not intersect with itself, i.e. it is a simple closed curve or Jordan curve.

Note 2 to entry: A closed profile is periodic with the finite period length L.

Note 3 to entry: A typical example of a closed profile is one from a roundness measurement.

[SOURCE: ISO 16610-1:2015, 3.8, modified — Note 2 to entry and Note 3 to entry added.]

3.2
linear profile filter
profile filter which separates surface profiles into large lateral scale and small lateral scale components and is also a linear function

Note 1 to entry: If F is a function and X and Y are profiles, then F is a linear function implies $\mathrm{F}(a\,\mathrm{X}+b\,\mathrm{Y})=a\,\mathrm{F}(\mathrm{X})+b\,\mathrm{F}(\mathrm{Y})$.

[SOURCE: ISO 16610-20:2015, 3.1]

3.3
robust profile filter
profile filter which separates profiles into large lateral scale and small lateral scale components and is insensitive against specific phenomena in the input data

Note 1 to entry: A robust profile filter is a non-linear filter.

Note 2 to entry: See also ISO 16610-1: 2015, 3.9.

Note 3 to entry: Outliers, scratches and steps are examples of specific phenomena. Further details can be found in ISO 16610-30:2015.

Note 4 to entry: In particular, the robust Gaussian regression filter defined in this document reduces the influence of specific phenomena such as protruding dales and hills. Profile examples are given in Annex B of this document.

3.4
biweight function of Beaton and Tukey
function used in M-estimation which weights ordinate values $\Delta z(x)$ according to their amplitude and is defined by Formula (1)

$$\delta(\Delta z(x),c)=\begin{cases}\left(1-\left(\dfrac{\Delta z(x)}{c}\right)^2\right)^2 & \text{for } |\Delta z(x)|\le c\\ 0 & \text{for } |\Delta z(x)|>c\end{cases} \tag{1}$$

where $\Delta z(x)$ are ordinate values and c is a scale constant.

Note 1 to entry: The biweight function $\delta(\Delta z(x),c)$ of Beaton and Tukey is almost constant for ordinate values $\Delta z(x)\ll c$. For increasing ordinate values $\Delta z(x)$ the weights approach zero.