
Specifikacija geometrijskih veličin izdelka (GPS) - Filtriranje - 62. del: Linearni ravni filtri: Utorni filtri (ISO/DIS 16610-62:2021)

Geometrical product specifications (GPS) - Filtration - Part 62: Linear areal filters: Spline filters (ISO/DIS 16610-62:2021)

Geometrische Produktspezifikation (GPS) - Filterung- Teil 62: Lineare Flächenfilter: Spline-Filter (ISO/DIS 16610 62:2021)

Spécification géométrique des produits (GPS) - Filtrage - Partie 62: Filtres surfaciques linéaires : Filtres spline (ISO/DIS 16610-62:2021)

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Linear areal filters: Spline filters

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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 <https://www.iso.org/directives-and-policies.html>).

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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: <https://www.iso.org/foreword-supplementary-information.html>.

This document was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

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 the feature characteristics and measurement chain links in the GPS matrix structure.

The ISO/GPS masterplan 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 B](#).

This document specifies the terminology and concepts for linear areal spline filters. It specifies how to separate long and short wave components of a surface with a global shape retainment.

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Geometrical product specifications (GPS) — Filtration —

Part 62: Linear areal filters: Spline filters

1 Scope

This document specifies the characteristics of a linear areal spline filter with a global shape retainment. It is the areal extension of the linear profilometric spline filter as specified in ISO 16610-22.

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

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

ISO 16610-22:2015, *Geometrical product specifications (GPS) — Filtration — Part 22: Linear profile filters: Spline filters*

ISO 16610-60, *Geometrical product specification (GPS) — Filtration — Part 60: Linear areal filters — Basic concepts*

ISO 16610-61, *Geometrical product specification (GPS) — Filtration — Part 61: Linear areal filters — Gaussian filters*

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 16610-21, ISO 16610-22, ISO 16610-60, ISO 16610-61, ISO/IEC Guide 99 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 spline

linear combination of piecewise polynomials, with a smooth fit between the pieces

[SOURCE: ISO 16610-22:2015, 3.1]

3.2 spline filter

linear filter based on splines

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3.3

linear areal filter

areal filter which separates surfaces into long wave and short wave components and is also a linear function

[SOURCE: ISO 16610-60:2015, 3.1]

3.3.1

linear planar filter

linear areal filter (3.3) which separates planar surfaces into long wave and short wave components, which applies to nominal planar surfaces

[SOURCE: ISO 16610-60:2015, 3.1.1]

3.3.2

linear cylindrical filter

linear areal filter (3.3) which separates cylindrical surfaces into long wave and short wave components, which applies to nominal cylindrical surfaces

[SOURCE: ISO 16610-60:2015, 3.1.2]

3.4

cut-off wavelength (nesting index)

wavelength of a sinusoidal surface of which 50 % of the amplitude is transmitted by the linear areal filter

Note 1 to entry: Linear areal filters are identified by the filter type and the cut-off wavelength.

Note 2 to entry: The cut-off value for the spline filter is an example of a nesting index.

Note 3 to entry: The cut-off 50 % value is by convention.

[SOURCE: ISO 16610-60:2015, 3.7]

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4 Spline areal filter

4.1 General

The following low-pass filter equation for spline profile filters is based on cubic splines with a regularization parameter depending on the cut-off wavelength for the smoothness of the resultant waviness profile (low-passed signal) and a tension parameter influencing the slope of the transfer function.

4.2 Filter equation for cubic spline filter for topography maps on uniformly sampled grids

4.2.1 General

The filter equation is given by [Formula \(1\)](#):

$$\mathbf{w} = \mathbf{A}_y \mathbf{z} \mathbf{A}_x^T \quad (1)$$

with \mathbf{z} being the $n \times m$ -dimensional matrix representing the height map of input data, e.g. the primary surface of $n \times m$ sampling points, and \mathbf{w} the $n \times m$ -dimensional matrix representing the height map of output data. The transformation matrices \mathbf{A}_x and \mathbf{A}_y are defined by [Formula \(2\)](#) and [Formula \(3\)](#):

$$\mathbf{A}_x = (\mathbf{E} + \beta \alpha_x^2 \mathbf{P} + (1 - \beta) \alpha_x^4 \mathbf{Q})^{-1} \quad (2)$$