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Geometriska produktspecifikationer (GPS) – Filtrering – Del 60: Linjära arealfilter: Grundläggande begrepp (ISO 16610-60:2015)

Geometrical Product Specification (GPS) – Filtration – Part 60: Linear areal filters: Basic concepts (ISO 16610-60:2015)

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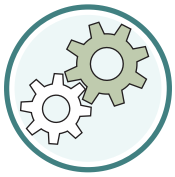

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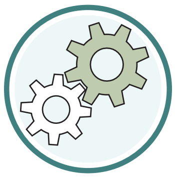

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The European Standard EN ISO 16610-60:2015 has the status of a Swedish Standard. This document contains the official English version of EN ISO 16610-60:2015.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

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Denna standard är framtagen av kommittén för Mätteknik GPS och Ytstruktur, SIS/TK 507/AG 6.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 16610-60

November 2015

ICS 17.040.30

English Version

Geometrical Product Specification (GPS) - Filtration - Part 60: Linear areal filters: Basic concepts (ISO 16610-60:2015)

Spécification géométrique des produits (GPS) - Filtrage - Partie 60: Filtres surfaciques linéaires - Concepts de base(ISO 16610-60:2015)

Geometrische Produktspezifikation (GPS) - Filterung - Teil 60: Lineare Flächenfilter: Grundlegende Konzepte (ISO 16610-60:2015)

This European Standard was approved by CEN on 12 March 2015.

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Ref. No. EN ISO 16610-60:2015 E

Contents

European foreword

This document (EN ISO 16610-60:2015) has been prepared by Technical Committee ISO/TC 213 "Dimensional and geometrical product specifications and verification" in collaboration with Technical Committee CEN/TC 290 "Dimensional and geometrical product specification and verification" the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

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Endorsement notice

The text of ISO 16610-60:2015 has been approved by CEN as EN ISO 16610-60:2015 without any modification.

Introduction

This part of ISO 16610 is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO 14638). It influences chain links C and F 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 part of ISO 16610 is a part. The fundamental rules of ISO/GPS given in ISO 8015 apply to this part of ISO 16610 and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this part of ISO 16610, unless otherwise indicated.

For more detailed information about the relation of this part of ISO 16610 to the GPS matrix model, see Annex C.

This part of ISO 16610 develops the basic concepts of linear areal filters, which include Gaussian filter, Spline filters, and Wavelet filters.

Geometrical product specification (GPS) — Filtration —

Part 60:
Linear areal filters — Basic concepts

1 Scope

This part of ISO 16610 sets out the basic concepts of linear areal filters.

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

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

ISO 16610-21:2011, *Geometrical product specifications (GPS) — Filtration — Part 21: Linear profile filters: Gaussian filters*

ISO/IEC Guide 99:2007, *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/IEC Guide 99, and the following apply.

3.1
linear areal filter
areal filter which separates surfaces into long wave and short wave components and is also a linear function

Note 1 to entry: If F is a function and X and Y are surfaces then F is a linear function implies F(aX + bY) = aF(X) + bF(Y).

Note 2 to entry: A linear areal filter is for surfaces in a specified coordinate system, for example, planar and cylindrical.

Note 3 to entry: Linear areal filter examples include Gaussian, spline, spline wavelet, and complex wavelet.

3.1.1
linear planar filter
linear areal filter (3.1) which separates planar surfaces into long wave and short wave components, which applies to nominal planar surfaces

Note 1 to entry: A planar surface is open in all directions.

3.1.2
linear cylindrical filter
linear areal filter (3.1) which separates cylindrical surfaces into long wave and short wave components, which applies to nominal cylindrical surface

Note 1 to entry: A cylindrical surface is open in the axial direction and closed in the circumferential direction.

3.2
phase correct areal filter
linear areal filter (3.1) which does not cause phase shifts leading to asymmetrical surface distortions

Note 1 to entry: Phase correct filters are a particular kind of linear phase filters because any linear phase filter can be transformed (simply by shifting its weighting function) to a zero phase filter, which is a phase correct filter.

3.3
mean surface
long wave surface component determined from the surface by application of an areal filter

3.4
weighting function
function for calculating the mean surface, which indicates for each point the weight attached by the surface in the vicinity of that point

3.5
filter equation
equation for the mathematical description of the filter

Note 1 to entry: Filter equations do not necessarily specify an algorithm for the numerical realization of the filter.

[SOURCE: ISO 16610-1:2015, 3.10]

3.6
transmission characteristic of an areal filter
characteristic that indicates the amount by which the amplitude of a sinusoidal surface is attenuated as a function of its wavelengths

Note 1 to entry: The transmission characteristic is the Fourier transformation of the weighting function.

3.7
cut-off wavelength (nesting index)
wavelength of a sinusoidal surface of which 50 % of the amplitude is transmitted by the *linear areal filter* (3.1)

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 linear areal filter is an example of a nesting index.

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

3.8
filter bank
set of high-pass and low-pass filters, arranged in a specified structure

[SOURCE: ISO 16610-20:2015, 3.6]

3.9
multiresolution analysis
decomposition of a surface by a *filter bank* (3.8) into portions of different scales

Note 1 to entry: The portions at different scales are also referred to as resolutions.

[SOURCE: ISO 16610-20:2015, 3.7]

4 Basic concepts

4.1 General

A filter claiming to comply with this part of ISO 16610 shall exhibit the characteristics described in 4.1, 4.2, 4.3, and 4.4.

NOTE A concept diagram for linear areal filters is given in Annex A. The relationship to the filtration matrix model is given in Annex B.

The most general linear areal filter is defined by Formula (1):

$$w(x,y)=\iint K(x,y;\mu,\upsilon)z(\mu,\upsilon)d\mu d\upsilon \quad (1)$$

where

$z\ (\mu,\upsilon)$	is the unfiltered surface;
$w\ (x,y)$	is the filtered surface;
$K\ (x, y{:}\ \mu, \upsilon)$	is the kernel of the filter, which is real, symmetric, and spatial invariant.

If $K(x,y;\mu,\upsilon)=K(x-\mu,y-\upsilon)$, the filtering is a convolution,

$$w(x,y)=\iint K(x-\mu,y-\upsilon)z(\mu,\upsilon)d\mu d\upsilon \quad (2)$$

and the kernel is also called the weighting function of the filter.

However, extracted data are always discrete. Therefore, the filters described here are also discrete. In cases that the weighting function is not discrete, the discrete nature of the extracted data shall be taken into account (see 4.3).

NOTE An alternative approach is to use a unique interpolation scheme on the discrete extracted data to create a continuous signal (with finite degrees of freedom) and use this as input to subsequent filtration operations.

4.2 Separable weighting functions

If the weighting function is separable, i.e. it can be written as a tensor product of profile filter weighting functions

$$K(x,y)=u(x)v(y) \quad (3)$$

the convolution is also a tensor product:

$$w(x,y)=\int u(x-\mu)\left[\int v(y-\upsilon)z(\mu,\upsilon)d\upsilon\right]d\mu \quad (4)$$

i.e. the convolution is separable, too. Thus, the convolution can be calculated in a two-step process, using profile filters instead of areal filters:

$$g(x,y)=\int v(y-\upsilon)z(x,\upsilon)d\upsilon \quad (5)$$

and

$$w(x,y)=\int u(x-\mu)g(\mu,y)d\mu \quad (6)$$