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AMENDMENT 1
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Geometrical product specification (GPS) — Filtration —

Part 61:
Linear areal filters — Gaussian filters

AMENDMENT 1

Spécification géométrique des produits (GPS) — Filtrage —

Partie 61: Filtres surfaciques linéaires : Filtres Gaussiens

AMENDEMENT 1

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

This document develops a concept of handling end effects in the case of the linear areal Gaussian filter.

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Geometrical product specification (GPS) — Filtration —

Part 61:
Linear areal filters — Gaussian filters

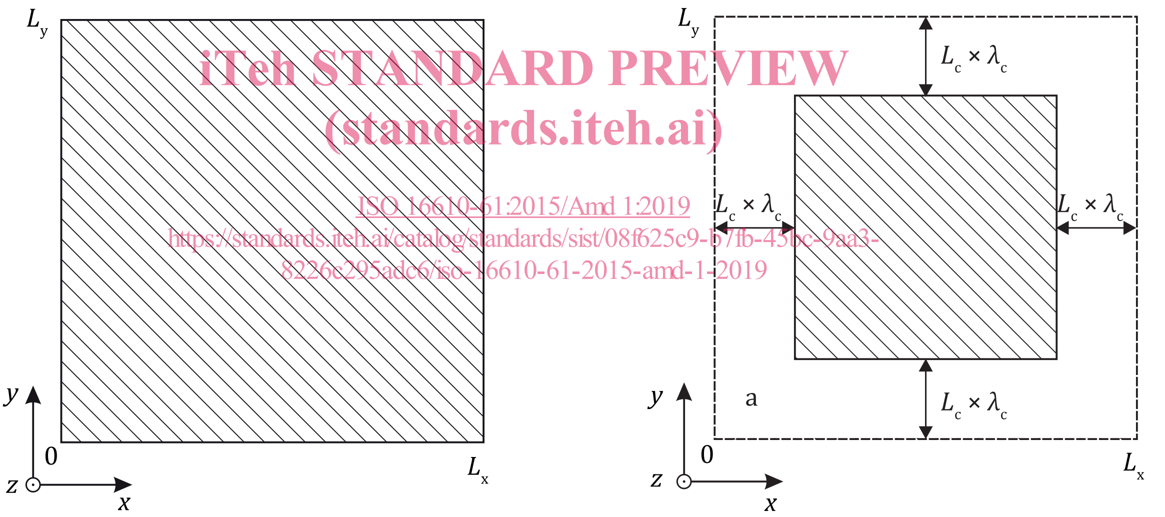
AMENDMENT 1

Add a new Clause 7 after 6.2:

7 Treatment of end effects

7.1 General

Depending on the chosen nesting indices, the filtered surface may be significantly smaller than the unfiltered surface due to end effects (see Figure 8 for linear planar Gaussian filters and Figure 9 for linear cylindrical Gaussian filters). If the end effects require treatment the moment retainment criterion with $p = 1$ shall be applied (see ISO 16610-28).

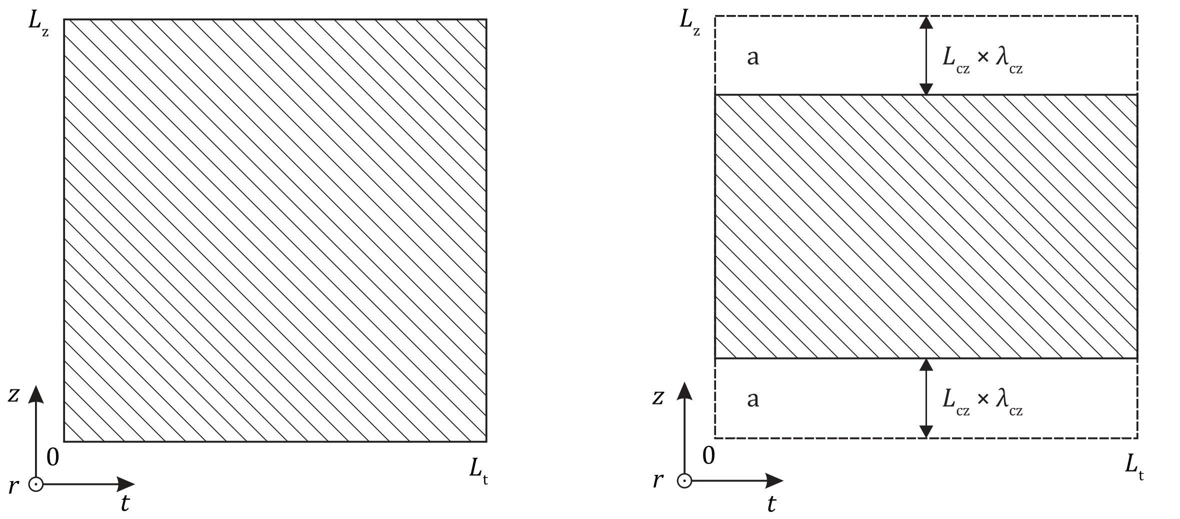


a) Surface (hatched area) before filtering b) Surface (hatched area) after filtering

Key

a region of end effects
L_x measuring length in x direction
L_y measuring length in y direction
λ_c nesting index (cut off wavelength)
L_c truncation index
x, y, z right-handed Cartesian coordinate system

Figure 8 — Region of end effects in case of a linear planar Gaussian filter



a) Surface (hatched area) before filtering **b) Surface (hatched area) after filtering**

Key

a region of end effects

L_t circumferential measuring length in t direction

L_z measuring length in z direction

λ_{cz} nesting index (cut off wavelength) in z direction

L_{cz} truncation index in z direction

t, z, r right-handed Cartesian coordinate system

Figure 9 — Region of end effects in case of a linear cylindrical Gaussian filter

7.2 Generalized filter operation for linear planar Gaussian filters

For linear planar Gaussian filters, the generalized filter operation is defined by Formula (19):

$$w(x,y)=\int_{\Omega_x}\int_{\Omega_y} z(x-u,y-v)\times\left(b_{00}(x,y)+u\times b_{10}(x,y)+v\times b_{01}(x,y)\right)\times s\left(u\middle|\lambda_c\right)\times s\left(v\middle|\lambda_c\right)dvdu \qquad (19)$$

where

u	is the integration variable in x direction;
v	is the integration variable in y direction;
$\Omega_x=\left[\max\left(x-L_x,-L_c\lambda_c\right),\min\left(x,L_c\lambda_c\right)\right]$	is the integration interval in x direction;
$\Omega_y=\left[\max\left(y-L_y,-L_c\lambda_c\right),\min\left(y,L_c\lambda_c\right)\right]$	is the integration interval in y direction;
$b_{00}(x,y),\ b_{10}(x,y),\ b_{01}(x,y)$	are the shift variant correction functions.

The shift variant correction functions shall be calculated by solving the matrix formula:

$$\begin{pmatrix} \mu_{00}(x,y) & \mu_{10}(x,y) & \mu_{01}(x,y) \\ \mu_{10}(x,y) & \mu_{20}(x,y) & \mu_{11}(x,y) \\ \mu_{01}(x,y) & \mu_{11}(x,y) & \mu_{02}(x,y) \end{pmatrix} \begin{pmatrix} b_{00}(x,y) \\ b_{10}(x,y) \\ b_{01}(x,y) \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$$

where $\mu_{ij}(x,y) = \int_{\Omega_x} u^i \times s(u|\lambda_c) du \times \int_{\Omega_y} v^j \times s(v|\lambda_c) dv$.

In the interior $L_c \lambda_c \le x \le L_x - L_c \lambda_c$ and $L_c \lambda_c \le y \le L_y - L_c \lambda_c$ the filter behaviour is given by Formula (4).

NOTE 1 The filter operation according to Formula (19) is not separable.

NOTE 2 For $L_c \to \infty$, the linear planar Gaussian filter is equal to the linear planar Gaussian regression filter according to ISO 16610-71, with $p = 1$.

7.3 Generalized filter operation for linear cylindrical Gaussian filters

For linear cylindrical Gaussian filters, the generalized filter operation is defined by Formula (20):

$$w(t,z) = \int_{\Omega_t} \int_{\Omega_z} r(t-u, z-v) \times (b_0(z) + v \times b_1(z)) \times s(u|f_c) \times s(v|\lambda_{cz}) dv du \qquad (20)$$

where

u	is the integration variable in t direction;
v	is the integration variable in z direction;
$\Omega_t = [-L_{ct} L/f_c, L_{ct} L/f_c]$	is the integration interval in t direction;
$\Omega_z = [\max(z - L_z, -L_{cz} \lambda_{cz}), \min(z, L_{cz} \lambda_{cz})]$	is the integration interval in z direction;
$b_0(z), b_1(z)$	are shift variant correction functions.

The shift variant correction functions shall be calculated by solving the matrix formula:

$$\begin{pmatrix} \mu_0(z) & \mu_1(z) \\ \mu_1(z) & \mu_2(z) \end{pmatrix} \begin{pmatrix} b_0(z) \\ b_1(z) \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

where $\mu_i(z) = \int_{\Omega_t} s(u|f_c) du \times \int_{\Omega_z} v^i \times s(v|\lambda_{cz}) dv$.

In the interior $L_{cz} \lambda_{cz} \le z \le L_z - L_{cz} \lambda_{cz}$ the filter behaviour is given by Formula (15) and Formula (16).

NOTE 1 The filter operation according to Formula (20) is separable.

NOTE 2 For $L_{ct} \to \infty$ and $L_{cz} \to \infty$, the linear cylindrical Gaussian filter is equal to the linear cylindrical Gaussian regression filter according to ISO 16610-71, with $p = 1$.

Add a new reference [7] to the Bibliography:

[7] SEEWIG J., LEACH R. (editor), et al. *Areal Filtering Methods in Characterisation of Areal Surface Texture*, Springer, 2013, pp 67–106

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