EFFECT OF TOOL GEOMETRY AND NOSE PROFILE MICRO-DEVIATION ON SURFACE ROUGHNESS IN FINISH TURNING

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EFFECT OF TOOL GEOMETRY AND NOSE PROFILE MICRO-DEVIATION ON SURFACE ROUGHNESS IN FINISH TURNING

by

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5X	the magnification of the lens
*	Convolution operator
α	Angle between left straight flank with vertical line (Figure 3.17)
κ_r	Major cutting edge angle
$\kappa_r{}'$	Side cutting edge angle
λ	Inclination angle
γ	Rake angle
ϵ_r	Included angle
Ω	Rotation angle to locate nose profile at appropriate side cutting edge angle
ϕ	Angle between *OL* and vertical line (Figure 3.21)
θ_e	Angle measured counterclockwise between the vertical line and the line connecting the point *O* to each nose profile point P_e (Figure 3.19)
θ_J	Start angle of rounded nose of edge profile
θ_K	End angle of rounded nose of edge profile
θ_L	Start angle of tool-workpiece interface
θ_l	Angle between left straight flank and the horizontal line (Figure 3.19)
θ_M	End angle of tool-workpiece interface
θ_r	Angle between right straight flank and the horizontal line (Figure 3.19)
ψ_1	Possibility of the data not come from a normally distributed population
ψ_2	Possibility of the data $R_{s(n_z+1)}$ will fall within the range

ΔT Sampling interval

a Major semi-axis of elliptical arc

a_p Predefined value for *DFP*

b Minor semi-axis of elliptical arc

c_t Constant to provide 50% transmission characteristic at the cut-off wavelength

D Diameter of workpiece

d_a Difference between the x-coordinate (x_N) of point N and x-coordinate (x_E) of point E (Figure 2.1)

d_b Horizontal distance between the peak and adjacent valley of the arc of the surface profile at the cutting portion produced by the rounded nose (Figure 2.1)

d_e Difference between y-coordinate (y_e) of the nose profile and y-coordinate (y_l) of the last detected pixel at the probable edge point in a column

DFP Difference between the y-coordinates of the first pixel at the probable edge point that detected from bottom up for two columns in image V_b

D_n Lilliefors' test statistic

d_s Tool cutting path in the circumferential direction

e Euler number

E Intersection point of the minor cutting edge and rounded nose as (Figure 2.1)

e_u Threshold value to select the probable edge point in the tool image

f Feed rate

g_1 Gradients of left straight flank of a tool

g_2 Gradients of right straight flank of a tool

$h(k)$ Displacement-frequency discrete signal

$h(p)$ Displacement-time discrete signal

$h(q)$ Displacement-frequency continuous signal

$h(t)$ Displacement-time continuous signal

i Imaginary number

j Row in image

L Start point of tool-workpiece interface

l_e Surface roughness evaluation length

l_m Total row in image

l_n Total column in image

l_r Length of the tool cutting path in one revolution

l_s Surface roughness sampling length

l_w Length of machined part of a workpiece

M End point of tool-workpiece interface

$\overline{m_c}$ Moments along the pixels at the probable edge points in image V_b, c is 1, 2 or 3

N Lowest point of the nose profile (Figure 2.1)

n_d Number of independent predicted data

n_p Point of workpiece

n_r Number of nose profile points P_e restricted in the rounded nose

n_s Number of selected points at the straight flanks

n_x Number of the pixels at the probable edge points in each column

n_z Sample size

p_1 Ratio d_e to n_x

P_d Rotated nose profile

P_{df} Nose profile contains the nose profile micro-deviation and nose wear

P_{dn} Rotated nose profile from new tool nose

P_{dw} Rotated nose profile from worn tool nose

P_e Nose profile

P_m Mean line workpiece profile

P_r Roughness workpiece profile

P_u Unmodified workpiece profile

r Nose radius

R_a Arithmetic average roughness

r_e Radial distance

R_{max} Highest peak roughness

R_{min} Lowest valley roughness

r_n Nominal nose radius

r_{opt} Optimum nose radius

r_p Predefined nose radius

R_q Root-mean-square roughness

R_s Average Surface roughness data of a workpiece obtained from simulation

R_t Maximum peak-to-valley roughness

R_w Surface roughness data in each workpiece obtained from simulation

R_z Ten-point roughness

s_1 First Sobel operator

s_2 Second Sobel operator

s_k Sampling frequency

s_R Standard deviation of the average surface roughness values of different workpiece

s_w Standard deviation of the surface roughness values of different points at workpiece

t Time

T Time period

$t.v$ Translation value

$t_{0.975,n_z-1}$ 97.5% quantile of a Student's *t*-distribution with n_z-1 degrees of freedom

u Spindle speed

U_m Image that having pixels with value represent the gradient of gray level in the *x*- and *y*-directions of the corresponding pixel in image V_{gs}

U_x Image that having pixels with value represent the gradient of gray level in the *x*-direction of the corresponding pixel in image V_{gs}

U_y Image that having pixels with value represent the gradient of gray level in the *y*-direction of the corresponding pixel in image V_{gs}

V_b Image consists of nose edge band

$v_c(k)$ Clean velocity-frequency discrete signal

$v_c(p)$ Clean velocity-time discrete signal

$v_e(k)$ Noise velocity-frequency discrete signal

$v_e(p)$ Noise velocity-time discrete signal

V_{gs} Gray-scale image

$v(p)$ Velocity-time discrete signal

$v(q)$ Velocity-frequency continuous signal

$v(t)$ Velocity-time continuous signal

$v_y(k)$ Noisy velocity-frequency discrete signal

$v_y(p)$ Noisy velocity-time discrete signal

w Weighing function

W_n Cutting edge normal plane

W_r Main reference plane

W_s Tool cutting edge plane

x_d x-coordinate of a point on the rotated nose profile P_d

x_e x-coordinate of a point on the nose profile P_e

x_i Number of a column in an image

x' Distance from the center (maximum) of the weighting function

y_d y-coordinate of a point on the rotated nose profile P_d

y_{df} y-coordinate of a point on the nose profile P_{df}

y_{dw} y-coordinate of a point on the nose profile P_{dw}

y_{dn} y-coordinate of a point on the nose profile P_{dn}

y_e y-coordinate of a point on the nose profile P_e

y_J Approximate y-coordinate of the point J

y_i Number of a row in an image

y_K Approximate y-coordinate of the point K

y_{min} Minimum y value

y_N Maximum y-coordinate of a point on the nose profile P_e