

**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**

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LIST OF SYMBOLS

$5X$	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
κ_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 <i>DFP</i>
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
<i>DFP</i>	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 weighing 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