Geometrical Optimization of Centerless Grinding Process by Profiled Workrest

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Abstract

This work presents a method to optimize centerless grinding geometrical configuration. It is based on the regulation of the horizontal axes of operating and rubbing wheels of the machine machine coupled with an opportune blade profile, allowing a continuous selection of workrest angle and workpiece height, without requiring blade substitution and/or manual interventions. The regulation of workrest angle and height cannot be done independently: their relationship is defined during blade profile design. In machines with two independent axes for regulating wheel and blade horizontal displacement, this regulation can be performed in process or in the setup phase and does not require manual blade adjustment/replacement. This results in optimal processing parameter choice leading to improved quality and shorter time of processing as well as reduced setup time.

Full Text

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Figures

Figure 1

Centerless grinding setup scheme

Figure 2

Schematic for mathematical definitions

Figure 3

Regulation kinematics ($R/r = 3$; blade thickness = $r/4$)

Convex WP workrest

Concave WP workrest

Figure 4

Convex and concave workrest profiles ($R/r = 3$; blade thickness = $r/4$ for convex profile and $r/2$ for concave profile)

Figure 5

Piecewise workrest profile

Figure 6

Gain map for a 2-stages process ($d_s = 500\text{mm}$, $d_{cw} = 300\text{mm}$, $d_w = 68\text{mm}$, $hw_1 = hw_2 = 20\text{mm}$, $n_1 = n_2 = 50\text{revs}$)

Figure 7

Examples of possible regulations (concave blade, positioned at three different heights)

convex and straight blade. Mean $\gamma = 30^\circ$, blade width = 0.0104 [m], WP radius=0.05 [m]

Figure 8

Examples of possible regulations (convex blade, positioned at three different heights))