CONTRIBUTION TO THE CUTTING TOOL GEOMETRY

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Abstract

This contribution is introducing another perspective on the cutting tool geometry*, than is this defined in relevant normative textbooks. Our sight is closer to principles of descriptive geometry and used imaging in technical drawing and is designated for students of second and third degree of university studies, who want to acquaint them with alternative interpretation of* ***the cutting tool geometry****.*

Key words

cutting tool, descriptive geometry, angles, planes, axises

Introduction

It was written a lot of articles about the cutting tool geometry. It always hade to be working on the assumption of normative, which one was change after some time. Not all aspects and not always in this normatives were choised right. It usually were problems which were found complicatedly. What brought a different criticism, which were sometimes useless.

We won't talk about it, but we focus our attention to one concrete problem, and it is the problem of deviding the elements of edges of cutting wedge instrumental coordinate system which one is needed for plan, production and sharpening of cutting wedge and then for exploatation of cutting wedge.

Constructional proposal of cutting wedge geometry wise

We will notice the cutting part of cutting tool, thus cutting wedge. This one is comprised from three plane, head plane (on this one the splinter is leaving) A_γ, main back plane A_α (is the closest to transitional surface between cultivated and cultivate surface of workpiece) and side back surface A'_α (is the closest to cultivate surface). Position of each plane in space (also the plane of cutting wedge) it can be given of two edges to some coordinate plane of coordinate and the cutting wedge can be characterized with six (despite the fact, that the body can be characterized woth three dimensions in space – length , width, height, but we dismiss these reports).

The problem is, that the geometry of cutting edge receded from descriptive geometry in time, which uses depictive planes – plan, elevation and profile view. The geometry of cutting wedge transfers the coordinate system via chosen point of cutting edge. It is precisely, but distant to usual technical drawing.

We overlap three axises through chosen point B of main cutting edge. The axis c is collinear with the direction of main movement, axis f is collinear with the direction of sliding movement and axis p is orthogonal to both presented (c, f). Axises f, p detemine instrumental elementary plane P_r, axises c, f determine instrumental lateral plane P_f and axises c, p determine instrumental back plane P_p. Instrumental plane of main cutting edge P_s is placed through main cutting edge and orthogonal to plane P_r and through next cutting edge, in point B', orthogonal to plane P_r is placed instrumental plane of side cutting edge P'_s. The instrumental orthogonal plane P_o is placed orthogonal to planes P_s and P_r through point B and instrumental orthogonal plane P'_o through point B' (what is sometimes forgotten). We can define instrumental standard planes P_n, P'_n orthogonal to cutting edge and orthogonal to trail of plane of a head A_γ in plane P_r we can define instrumental plane of the biggest gradient of head P_g (or also P'_g) and orthogonal to trail of plane back A_α in plane P_r we can define instrumental plane of the biggest gradient of back P_b (or P'_b , when we are considering trail of plane A'_α).

We can determine three angles in instrumental basic plane: anlge of setting of main cutting edge $\chi_r = (P_s, P_f)$ angle of setting of side cutting edge $\chi_r = (P'_s, P_f)$ and angle of point ε_r which one is formed form planes P_s and P'_s, so $\varepsilon_r = (P_s, P'_s)$. We can also define three angles in instrumental orthogonal plane: instrumental orthogonal angle of head $\gamma_o = (A_\gamma, P_r)$, instrumental orthogonal angle of back $\alpha_o = (A_\alpha, P_s)$, instrumental orthogonal angle of cutting wedge β_o which is composed with planes A_γ, A_α, so $\beta_o = (A_\gamma, A_\alpha)$.

Analogically we can define in instrumental normal plane anlges: α_n, β_n, γ_n. We can define the angle of inclination of main cutting edge λ_s regulation $\lambda_s = (S, P_r)$, where S is main cutting edge, in normal plane of main cutting edge P_s and similarly in instrumental plane of next cutting edge P'_s - we can define angle of inclination of next cutting edge $\lambda'_s = (S', P_r)$, where S' is next cutting edge. We can define instrumental angle of the biggest inclination of head $\gamma_g = (A_\gamma, P_r)$ in instrumental plane of the bigges inclination of head P_g. We can define instrument angle of the biggest inclination of main back $\alpha_b = (A_\alpha, P_s)$ in instrumental plane of the biggest inclination of main back P_b. Analytically, we can define instrumental angle of the biggest inclination of next back $\alpha'_b = (A'_\alpha, P'_s)$ in instrumental plane of the biggest inclination of next back P'_b . We can also define instrumental edges of position of planes P_g, P_b, P'_b in view of plane P_f as angles δ_r, σ_r, σ'_r. We can difine angle $\chi_p = (p_p, f)$ yet, where p_p is trail of plane of head A_p in instrumental basic plane P_r. We define angle $\chi_\alpha = (p_\alpha, f)$ yet, where p_α is the trail of main back plane A_α in instrumental basic plane P_r. Analogically we can define angle $\chi'_\alpha = (p'_\alpha, f)$, where p'_α is a trail of next back surface A'_α in instrumental basic plane P_r. We suppose already made prism *axbxl*, where *a* is the width of tool) holder, *b* is the lenght of tool holder and *l* is the lenght of the tool. We want to make straight rougheining planer real turning tool monolithic (from one piece). It is needed to make cutting wedge, that means planes A_γ, A_α, A'_α and we need to know positin of point (point of intersection of main and next cutting edge) and the lenght of main cutting edge and also next cutting edge by creating of angles χ_r a χ'_r.

Then we can define six edges of gutting wedges for making : (χ_r, α_o, χ'_r, α'_o, γ_f, γ_p). Six edges of cutting wedge for its resharpening: (χ_γ, γ_g, χ_α, α_b, χ'_α, α'_b) or (γ_f, γ_p, α_f, α_p, α'_f, α'_p). Six elements of cutting wedge for its exploatation (usefull in manufacturing): (χ_r, χ'_r, α_o, γ_o, λ_s, r_ε) and the last element is radius of point (also can be deduction b_ε). We also can choose another six (for example if we don't sharpen next back, i tis enought to use four parts). Deviding of edges like this (on making, shapring, exploating) does not replace the useing or exclusion of using of working coordinate system and working edges, what are another problems.

Conclusion

The geometry of cutting wedge is not simply issue. Our sight to geometry is closer to descriptive geometry than valid norm. Our alternative sight to geometry of cutting wedge can be useful for students of second and third degree, who are working with these problems.

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