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CONSTRUCŢII DE MAŞINI

SPECIFIC CONDITIONS OF USING MILLING INSERTS

BY

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Abstract. The increasing use of machining centers, CNC milling small and most suitable machine for machining fragile parts makes it necessary milling tools with a better power-efficiency and allowing a smoother cut report. Cutting forces play an important role this level.

Key words: milling, round inserts, cutting deep.

1. Introduction

When it is decided that a part should be machined by milling, the next step is to choose the right machine: universal milling machine, horizontal, vertical, gantry, or numerically controlled machining centers, the best solution for the operation in question (Prod’homme, 1996). Once obtained a good compatibility between machining parameters and capabilities of the machine chosen, should be determined by factors such as stability, precision and thoroughness for desired surface. Instability is the main threat in metal

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machining by machining, not only for the quality of the results, but also as regards the life and performance of the inserts.

2. Using Round Inserts for Milling

The angle of attack of a milling has a decisive influence on the cutting performance, these effects depend on the angle at which the cutting edge meet the part, the action of cutting forces and the pressure distribution along the length of the cutting edge (Pruvot, 1997).

The angle of attack of a round insert milling is variable, the actual value which changes depending on the relationship between the radial cutting width (ae) and the diameter of the insert (D) (Fig. 1).

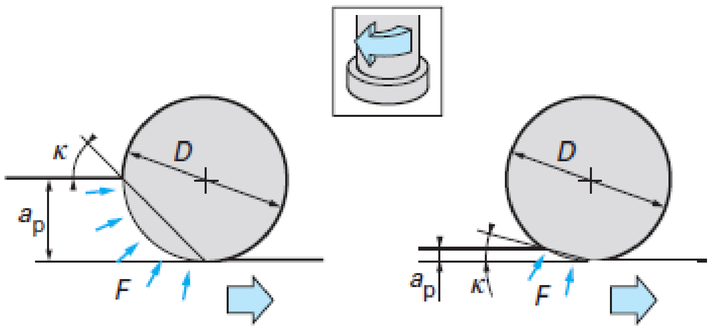


Fig. 1 – Change the angle of attack of a round insert cutter depending on the depth of cut a_p.

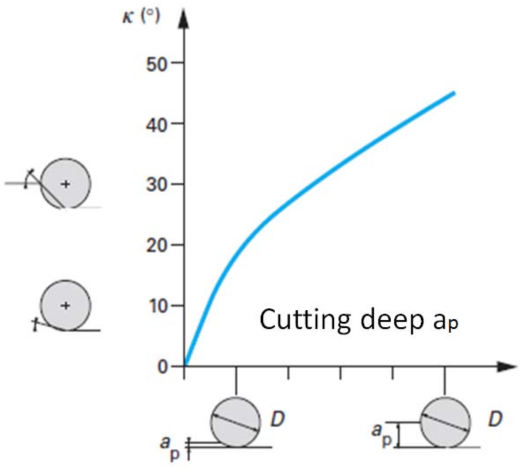


Fig. 2 – K curve variation versus a_p.

Starting from 0^0, the effective angle of attack reaches 45^0 when the depth of cut is equal to half the diameter of the insert, which is also the maximum depth of cut (Fig. 2).

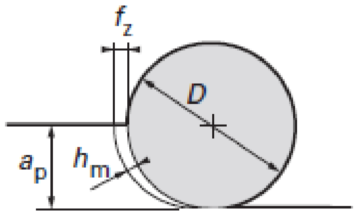


Fig. 3 − Variation with the advance tooth f_z chip thickness hm for round insert cutters.

The fact that the chip thickness varies with the feed per tooth (f_z) also applies to round insert cutters, but this thickness is also affected by the depth of cut (Fig. 3). It is therefore important, for surface milling, of keeping the average chip thickness under control to ensure correct feed per tooth and follow the recommendations in power consumption (Sachot, 1995).

The round cut edge is the strongest that exists and can be very productive when chosen wisely and properly used (Fig. 4).

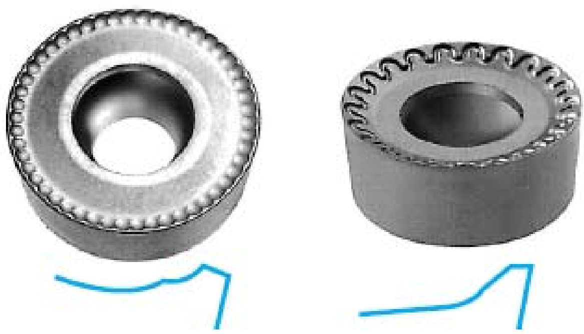


Fig. 4 − Different types of cutting edges for round inserts.

2. Positive Milling: More than Just another Power Source

Choosing of the pitch: large, small or thin, allow to each operation perform in the best possible conditions Table 1. The reduced pitch, which was the general, it's replaced by a larger one, that can be motivated by improving the performance in case of lack of stability, lack of power machine or tool vibration. The thin pitch, it is the best choice for short chipping materials, titanium, in stable conditions or in the presence of small radial depths of cut Table 2.

By changing the cutting angle to make it more positive, it reduces the deformation of the work piece material the cutting forces generated, and the power consumption. This does not mean in practice that the inserts that have more positive and sharp edges are more fragile.

Table 1

Step to choose according to the concerned operation

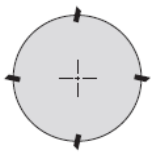
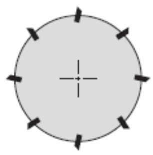
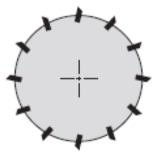
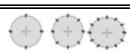
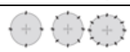
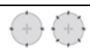
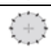
Method		
		
Problems solutions: - when combined with modular tools (extensions) and dampened adapters - on machines with low spindle power - on unstable machines requiring reduced cutting forces - for thin-walled components or requiring stable attachment to reduce the number of edges in engagement.	First choice for general milling	For improved productivity under specific conditions: - for milling short-chipping materials such as cast iron, under stable conditions; - with small radial depths of cut; - when the machining is limited by a low speed cutting (for example in titanium and titanium alloys).

Table 2

Surface milling capacity

Cutter diameter (mm)	a_p (mm)	Step u/Z	Inserts	Machining		
				L	A	H
40-80	15			**o**	*o*	
40-250	12.7			*o*	**o**	*o*
80-500	13-19				*o*	**o**
80-250	18			*o*	**o**	*o*
125-500	18			**o**	**o**	**o**
L light machining; A average machining; H heavy machining.						

The angle is probably smaller, but the cutting forces are appropriately redirected to an area of the insert receiving better support and made of a harder material.

The inserts with positive geometry have become the basic choice for surfacing, face milling and grooving. This concept has been adapted to specific geometries of edges based on a wide variety of operations.

In principle, there are three categories each corresponding to one of the following applications: light machining, average processing and heavy machining.

For light machining, there are inserts that have the most positive and strongest geometry, which makes them particularly suitable for smaller, less powerful machines and finishing passes. They have a strong edge, but sharp enough to provide a positive cut with feed reduced to a minimum per tooth.

The average machining involves good versatility, with chamfer backing for hard conditions. These types of inserts support higher feeds and allow machining hardest materials.

The heavy machining operations involving heavy feeds, deeper cutting, harder materials and more powerful machines, require a particularly strong cutting edge.

Round inserts, although they have the reputation of generating high cutting forces and consume a lot of power, are, also, available with positive geometry. The tendency to vibration is reduced to a minimum, even when the removal rate is high in rough or finish operations.

5. Conclusions

When the quality of the finished surface increases, machining costs are generally the same. This is why it is vital to specify the parameters of surface structure, taking into account specific requirements for affected parts.

Current recommendations differ considerably by what they once were. Some of them are the following:

- Minimize the distance between the locking pin and the cutting edge.
- Choose the largest possible diameter.
- Select climb milling for roughing.
- Facilitate chip evacuation.
- Use milling high feed to reduce the tendency to vibration.
- Check that the part is properly secured and that the holder is able to resist the cutting forces involved.
- Control the average thickness of the chips depending on the feed per tooth.

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CONDITII SPECIALE DE UTILIZARE
A PLĂCUȚELOR AȘCHIETOARE

(Rezumat)

Lucraerea prezintă aspecte privind utilizarea tot mai mare pe centre de prelucrare de frezat CNC, mașini-unelte mici sau medii pentru prelucrarea pieselor cu prelucrabilitate redusă (cum ar fi piese cu pereți subțiri, materiale dure) a sculelor așchietoare necesare pentru o mai bună putere-eficiență.