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Summary

It is generally recognized that tool wear has a great influence on the cutting forces and the quality of the machined surface. Especially when making smaller cuts, for instance in high-precision cutting, this influence is considerable. Besides its effect on the surface roughness it is obvious that a less sharp tool will lead to higher cutting forces. This will lead to more power dissipation in the cutting process, more heat development and to thermal expansion. Cutting with a blunt tool will therefore decrease machining accuracy.

In this study the influence of tool edge bluntness on the cutting forces is investigated. The tool edge bluntness has been approximated by an edge roundness. Flank wear is assumed to be negligible.

Rough cutting experiments have been carried out using tools having varying degrees of edge roundness. Preliminary rough cutting experiments were employed since in high precision cutting a defined edge roundness is very difficult to obtain and to measure. In rough cutting this edge roundness is larger. The experiments were carried out using tool inserts ground with edge radii varying between 0.10 mm and 0.20 mm. Cutting was performed with feedrates varying between 0.04 mm/rev and 0.20 mm/rev, depending on the radius of the tool edge. The workpiece material was steel C45.

High-precision cutting experiments have been carried out using diamond tools ground with an edge radius of 20 μm. Cutting was performed with feedrates varying between 3 μm/rev and 20 μm/rev. The workpiece material was free turning brass (CuZn40Pb3), it is shown that diamond cutting of steel is not possible.

Force measurement results are presented and discussed. The specific cutting forces are plotted against the ratio depth of cut/cutting edge radius. Approximately logarithmic relationships are evidenced.