GENERAL TOOL-LIFE FUNCTION IN CUTTING OPTIMISATION

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Tool life is the most important characteristic of cutting ability. According to the traditional Taylor formula $T=f(v_c)$, the tool life of the cutting tool T is considered as a function of the cutting speed at constant speeds in which the higher the speed, the lower the tool life. However it is valid only for a monotonously decreasing T-v_c curve. To describe a T-v_c curve having extreme values as well, a general tool life function proved by cutting experiments is proposed.

A frequent problem is, however, that cutting goes on sequentially with the same tool at several different speeds, and then this formula can be used only with difficulty. With periodically (in stages) changing cutting speed (in accordance of each v_{ci} with each Δt_i) the equation $\Delta t_i/T_i \approx 1$ is valid theoretically and experiments have proven this.

From this a general form of T-v_c curve can be deduced which can also be used with cutting at periodically changing cutting speeds. In the case of cutting at different speeds, an equivalent speed and the related tool life can be defined which can already been handled by the general tool-life function. By the calculation of the equivalent speed it is possible to define the T-v_c curve under manufacturing conditions, even in cutting with changing speed, and the general tool life function can be defined by operational measurements.

The applicability of the general tool life function extended to the cutting with changing or alternate speed can be illustrated well in the examples of face turning and taper turning and also by the economic examination of tool performance.

Several points of view have to be considered in economic examinations of cutting; however, in the present case the aim of the economic analysis is to explore how the tool life influences the economy and productivity.

Productivity can be characterised in the simplest way by the material volume cut during a time unit. To define the cutting speed economically from the point of view of tool life, it is expedient to calculate the cost of cutting of the material quantity by unit of volume.

Thus the general tool-life equation can be defined even under manufacturing conditions. Its applicability is demonstrated at cutting optimisation.