

## OPTIMIZATION OF CUTTING PROCESS AT THE HIGH-SPEED BROACHING OF GAS-TURBINE ENGINE PARTS

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### Abstract

Experience of application of optimum cutting at high-speed orthogonal cutting of details is presented. The generalized analytical and experimental mathematical models of calculation of optimum cutting conditions are developed at orthogonal cutting of scales aviation steels and alloys.

Traditionally, the broaching of gas-turbine engine parts used and is using today at many engine-building factories in our country and abroad with very low cutting speed (0,5–4 m/min), using broaching tools from different high-speed steels.

Complex experimental and theoretical researches of broaching have been carried out for 30 different high-temperature strength steels and alloys. The broaching was investigated in wide range of cutting speed 1.5–60 m/min using upgraded and high-speed broaching machines with high-speed and special designed hard-alloy broaching tools.

As a result of broaching researches it proved and confirmed with long-term practice, that optimum cutting speed should be over the range from 20 up to 40 m/min and more for different groups of difficult machining steels and alloys.

Are inferred experimental and analytical forms of best temperature values and cutting speed which have allowed to develop a new mode of broaching by multisection hard-alloy broaching tools using optimal cutting conditions. Thus cutting speed at the moment of input in operation fair sections протяжек do not decrease as before, and, on the contrary, increase to optimal values.

High speed broaching is realized in OJSC «Perm Engine Company» on 12th upgraded broaching 7A540 machines with cutting speed 25–30 m/min. It has allowed to increase efficiency of machining in 3–4 times. Lifetime of broaching tools has increased in 10 and more times. For example, at machining compressor vane roots with 70 mm length from BT3-1 titanium alloy, the amount of machining vanes between resharpenings has achieved 2000 pieces. Quality of machining roots has considerably increased and began more stable.

The basic results are introduced in OJSC «Perm Engine Company» at production of gas-turbine engines for energetic and gas-turbine engines of different power and also at production of new modern aircraft engine PS-90A for airplanes Ilyushin-96-300, Tupolev-204, etc. Operations on research and introducing of high-speed broaching proceed for more difficult half-closed slot surfaces in disks and new engines rings.