Novikov F. Theoretical substantiation of the conditions for reducing cutting force and temperature during blade and abrasive processing / F. Novikov, D. Novikov, V. Zhovtobryukh and other // Advanced Manufacturing Processes: Book of Abstracts of the 7th Grabchenko's International Conference on Advanced Manufacturing Processes, Kielce, Poland, September 23-26, 2025 / Vitalii Ivanov, Volodymyr Tonkonogyi, Slawomir Luściński (Eds.). – Sumy: IATDI, 2025. – P. 75.

Novikov F., Novikov D., Zhovtobryukh V., Yermolenko O.,
Ivashura A.

Theoretical substantiation of the conditions for reducing cutting force and temperature during blade and abrasive processing

Abstract

The aim of the work is to create a generalized mathematical model for determining cutting force, temperature, and energy intensity of processing, as well as to substantiate the conditions for their reduction during blade and abrasive processing. It is shown that the main condition for their reduction is to reduce to zero the angle of action, which is equal to the difference between the conditional angle of friction that occurs in the processing zone and the positive rake angle of the tool. In this case, the energy intensity of processing is equal to the compressive strength of the processed material, and the cutting force and temperature become the minimum possible, depending on the energy intensity of processing. This condition can be implemented during cutting with blade tools, since during grinding the conditional rake angle of the cutting grains is negative, and the angle of action exceeds the value of 45o. For this, the conditional angle of friction and the rake angle of the tool (due to its design) must be approximately equal. It has been experimentally established that this is achieved during high-speed cutting with prefabricated carbide blade tools with increased physical and mechanical properties, which significantly exceed traditional carbide cutting tools in terms of service life before blunting. As a result, it was possible to significantly increase productivity and ensure high quality of processing. On this basis, effective technological processes for processing parts of hydraulic systems have been developed.

Keywords: processing energy intensity, grinding, cutting tool, carbide