

The Cooling Design of a High-Speed Rotating Axis with Ribbed Turbulators

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Abstract

This work experimentally and numerically investigated the heat transfer characteristics of the high-speed rotating axis of five-axis processing machines. The test section of rotation axis possesses the novel design with ribbed turbulators to strengthen heat dissipation. A good cooling design will reduce the coefficient of thermal expansion, the thermal deformation and the damage of cutting tools to enhance the delicacy and the efficiency of the processing machining. In order to make the analysis meaningful, the experimental condition was made as close to the working of the real high-speed rotation axis as possible, and the oil was employed as the coolant. The relevant experiments analyzed the heat transfer distributions in radial directions and the axial directions of the rotor located in the test section of round cylinder with different rotational speeds. The empirical formula based on the test results was proposed to provide critical references for machining delicacy improvement in five-axis processing machines.

Keywords: heat transfer, high-speed rotation, five-axis processing machine, ribbed turbulators

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