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Thermal Model of High-Speed Spindle Units

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ABSTRACT

For the purpose to facilitate development of high-speed Spindle Units (SUs) running on rolling bearings, we have developed a beam element model, algorithms, and software for computer analysis of thermal characteristics of SUs. The thermal model incorporates a model of heat generation in rolling bearings, a model of heat transfer from bearings, and models for estimation of temperature and temperature deformations of SU elements. We have carried out experimental test and made quantitative evaluation of the effect of operation conditions on friction and thermal characteristics of the SUs of grinding and turning machines of typical structures. It is found that the operation conditions make stronger effect on SU temperatures when rpm increases. A comparison between the results of analysis and experiment proves their good mutual correspondence and allows us to recommend application of the models and software developed for design and research of high-speed SUs running on rolling bearings.

KEYWORDS

Thermal Model, High-Speed, Spindle, Unit, Rolling Bearing

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