Dynamic Analysis for High-speed Cutters of Five-axis CNC Milling Machine

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Cutter vibration characteristics of five-axis milling machine in high-speed milling process were studied. Finite Element Modal Analysis for high-speed cutters with different parameters is conducted using finite element software.The impact of tooth number, extended length, diameter and material of milling cutter on the mode shapes and natural frequencies of milling cutter is researched in detail. Harmonic response curves of High-speed cutter under different frequency are calculated. Based on the response curve, the resonance frequency range of high-speed cutter is obtained in order to achieve high-precision milling and longer life of the tool. Analysis shows that: mode shapes of milling cutter are divided into strong vibration mode shapes and weak vibration mode shapes and its natural frequency become smaller with the increase of the cutter teeth number. Natural frequency of milling cutter decreases with the increase of extended length of milling cutter. The number of strong vibration mode is smaller with the increase of milling cutter diameter so that the milling cutter with large diameter can play a role of anti-vibration. Natural frequency of the high-speed steel cutter is lower than that of the diamond and carbide cutter. This research provides theoretical basis for the design of high speed milling cutter and reducing milling chatter.

Keywords: High-speed cutter, Vibration characteristics, Modal shape, Harmonic response analysis

Acknowledgement
This paper is supported by the National Natural Science Foundation of China (Grant No.51375411;51205336).

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Paper number: M2014118