

Effect of the Tooling Conditions on the Machining Stability of a Milling Machine

Authors : Jui-Pui Hung, Yong-Run Chen, Wei-Cheng Shih, Shen-He Tsui, Kung-Da Wu

Abstract : This paper presents the effect on the tooling conditions on the machining stabilities of a milling machine tool. The machining stability was evaluated in different feeding direction in the X-Y plane, which was referred as the orientation-dependent machining stability. According to the machining mechanics, the machining stability was determined by the frequency response function of the cutter. Thus, we first conducted the vibration tests on the spindle tool of the milling machine to assess the tool tip frequency response functions along the principal direction of the machine tool. Then, basing on the orientation dependent stability analysis model proposed in this study, we evaluated the variation of the dynamic characteristics of the spindle tool and the corresponding machining stabilities at a specific feeding direction. Current results demonstrate that the stability boundaries and limited axial cutting depth of a specific cutter were affected to vary when it was fixed in the tool holder with different overhang length. The flute of the cutter also affects the stability boundary. When a two flute cutter was used, the critical cutting depth can be increased by 47 % as compared with the four flute cutter. The results presented in study provide valuable references for the selection of the tooling conditions for achieving high milling performance.

Keywords : tooling condition, machining stability, milling machine, chatter

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