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Milling chatter suppression in viscous fluid: a feasibility study

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Abstract

During the machining process, chatter is the key factor that limits productivity. In the present study, experimental investigations are concerned which assess the feasibility by submerging the milling system in viscous fluid to mitigate milling chatter. Higher stability limit is obtained with the proposed approach, which indicates that the milling efficiency can be improved greatly under viscous fluid condition. The stability improvement can be attributed to the variations of the milling system dynamic characteristics and cutting force coefficients. Due to the extra energy loss, the damping of the milling system increases significantly under viscous fluid condition. The rigidity of the workpiece remains unchanged while the frequency of the milling system decreases due to the added mass of the viscous fluid. Additionally, the cutting force coefficients are calibrated and the results indicate that compared with the dry milling the cutting force coefficients reduce significantly under viscous fluid condition. The explanations are verified by the experiments, which validate the effectiveness of the proposed approach on the suppression of milling chatter.

Keywords: Chatter suppression; Milling stability; Viscous fluid; Cutting force

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