

Numerical and analytical investigation of chatter suppression by parametric excitation

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Abstract: A concept for increasing process stability during milling is presented utilizing the time-periodic modulation of the tool support. A simple time-delayed system describing the effect of regenerative chatter is enhanced by a time-periodic variation of the support. Such a system leads to entirely new dynamics. Numerical results of stability charts are discussed in terms of spindle speed and cut depth and show classic chatter lobes that are modified by the parametric excitation. This kind of parametric excitation is more general than the one occurring for varying spindle speed because its frequency is independent of the cutting frequency of the tool and therefore independent of the spindle speed and number of teeth. First analytical approximations on the stability of the modified lobes are benchmarked against numerical predictions. This study is a preparation for experimental tests.

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