Public Abstract

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Title:EXPERIMENTAL AND NUMERICAL INVESTIGATION OF SUBCRITICAL BIFURCATIONS IN MILLING

The focus of the current thesis is an experimental and numerical investigation of subcritical bifurcations in milling. More specifically, several researchers have reported results indicating that the secondary Hopf bifurcations of turning processes are subcritical. However, fewer results are available for milling - especially results that provide any substantial experimental evidence. Therefore, experimental cutting tests are performed on a relatively long aluminum workpiece. The atypical length of the work piece will be used so that the depth of cut may be slowly increased or decreased during the cutting process. This provides visual evidence of hysteresis in the bifurcation diagram and the existence of multiple stable periodic solutions. The importance of this exploratory experimental effort is that multiple attractors may exist (stable periodic solutions) for the same cutting speed and depth of cut, but only one of these solutions would be the chatter free case. An important outcome from these results is that a small perturbation in the desirable stable solution near the borders of the stability diagram could result in a jump to the unstable cutting condition.