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Chapter 9

Influence of the Elastic System and Cutting Parameters on Chatter During End Milling Of Aluminium And Aluminium Alloy on VMC

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1.0 INTRODUCTION

Machine tool chatter is an intensive type of vibration of the work-tool-fixture (WTF) system during metal cutting. It is caused by interaction of the instability of the chip formation process and natural frequencies of the individual components of the WTF system [1, 2, 3]. It was established earlier [1, 2] and confirmed by recent investigations [4] that the chip formation process is unstable for most materials due to the formation of a fourth type of chip; namely the serrated, segmented or cyclic chip at cutting speed exceed certain critical value. When the frequencies of the instability of these serrated chip formation grow close to the natural frequencies of the individual components, resonance occurs [1, 2]. During resonance the frequency of the vibration remains practically constant and the amplitude increases to a maximum value and the gradually decreases and the component gets out of resonance [3]. This type of vibration during metal cutting is termed as chatter vibrations. The occurrence of chatter, if uncontrolled, can easily result in a poor surface finish, damaged cutting tool, and an irritating and unacceptable noise. In recent years, chatter research has been concentrated into the automatic suppression of machine tool chatter using various control strategies. One of the easy, effective, and popular chatter control strategies is the change of spindle speed [5]. This is because through a proper selection of spindle speed, a favourable condition may be generated to remove machine tool chatter. The main feature of the spindle speed control strategies is that stable spindle speeds can easily be searched without altering any machine tool structure. In the absence of stability data it is very difficult to program for the depth of cut, feed and cutting speed of the tool in order to maintain a satisfactory level of dynamic stability of the machine