

MECHATRONICS BOOK SERIES
SELECTED PAPERS FROM
ICOM'01, ICOM'05 AND
ICOM'08

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INVESTIGATION OF CHATTER ARISING DURING END MILLING OPERATION ON VMC AND QUALITY OF MACHINED SURFACE*

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ABSTRACT

Machine tool chatter is a dynamic instability of the cutting process. Chatter results in a poor surface finish, damaged cutting tool, and an irritating and unacceptable noise. Extensive research has been undertaken to study the mechanisms of chatter vibration. Efforts were also made to prevent the occurrence of chatter vibration. Even though some progress has been made, fundamental studies on the mechanics of metal cutting are necessary to achieve chatter free operation on CNC machine tools especially Vertical Machining Centre (VMC) operating at high cutting speeds and capable of high metal removal rates. The present work deals with the effect of work materials, cutting conditions and diameter of end mill cutters on frequency amplitude characteristics of chatter and on machined surface roughness. Vibration data were recorded using an experimental rig consisting of KISTLER 3-Component Dynamometer Type 9257B, Amplifier, Scope meters and a PC. Three different types of vibrations were observed. The first type was low frequency vibration, associated with the interrupted nature of end mill operation. The second type of vibration was associated with the instability of the chip formation process and the third type was due to chatter. The frequency of the last type remained practically unchanged over a wide range of cutting speed. It was further observed that chip-tool contact processes had considerable effect on roughness of the machined surface.

Keywords: Chatter, Cutting Conditions, Stable Cutting, Surface Roughness

1. INTRODUCTION

Chatter is a type of self-excited vibration, which appears during metal cutting process. It is undesirable but some times difficult to avoid during machining. Chatter leads to continuous variations in relative positions of cutter and the work piece which leads to low accuracy and surface finish of the work piece. Chatter is also harmful from the point of view of machine and tool life and noise hazards. Research in this area has