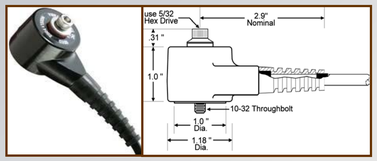
IPRO 304: IMPROVING MANUFACTURING PROCESS CONTROLS

Machine Tool Failure Detection

Introduction

A new technology is needed in aiding ***A. Finkl & Sons*** in the detection of cutting insert failure during the milling process. Currently, an operator must be present during the operation, which leads to much *wasted time* and *decreased productivity*.

The Team



The Objective

The objective is to develop a method to **automatically sense and report damages** to the cutting inserts in real time from a remote location, allowing the **operation of multiple machines at the same time**. This system will involve measuring vibrations using an accelerometer.

Past Methods

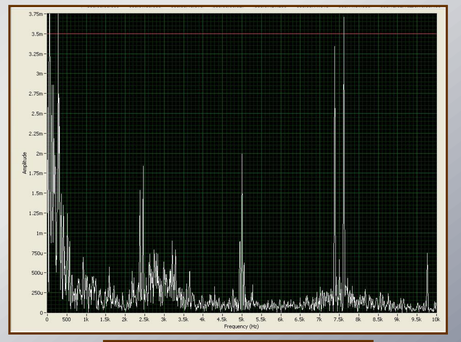
Acoustic signs
Visual analysis
Power load

The Problem

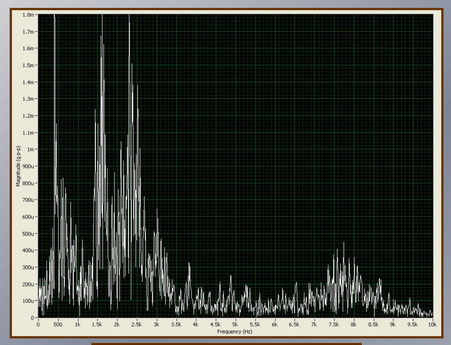
When a cutting insert breaks, it can lead to a catastrophic failure of the entire milling machine, resulting in *tens of thousands of dollars of damage*. An accelerometer is used to measure the vibration characteristics of the machine to detect failures. However, clear data could not be obtained from some of the machines.

Possible reasons:

- Excess vibrations drowning out signal due to lack of foundation
- Different depths of cut and feed rates
- Different machine natural frequencies

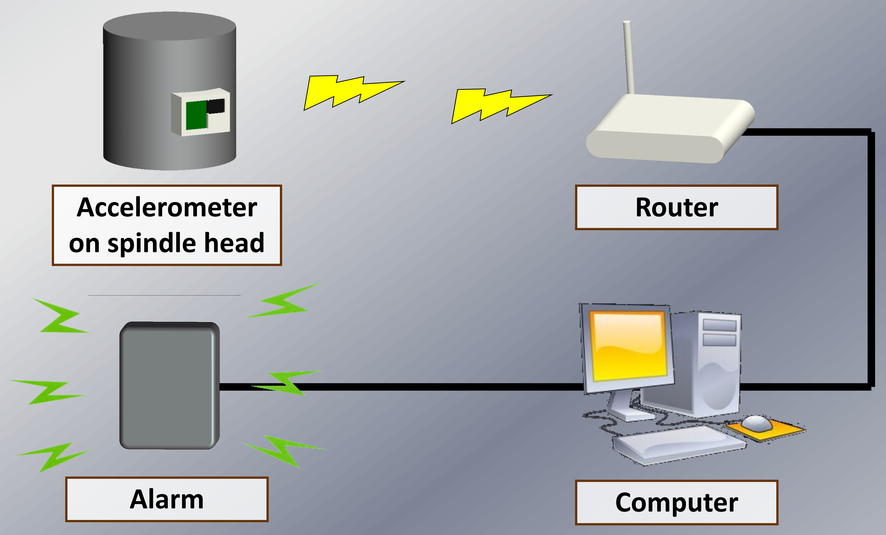


Working signal



Non-working signal

In a normal working signal (left), a distinctive rise in the intensity level at a certain frequency indicates a failure of a cutting insert. The non-working signal (right) displays many unclear peaks at a wide range of frequencies.



The Solution

A new wireless accelerometer is implemented. This will allow the sensor to be mounted directly onto the rotating spindle head and thereby closer to the cutting inserts, resulting in **more accurate, uninhibited data**. The wireless capability also allows the signals to travel further, providing the **freedom of choosing the receiver location**.