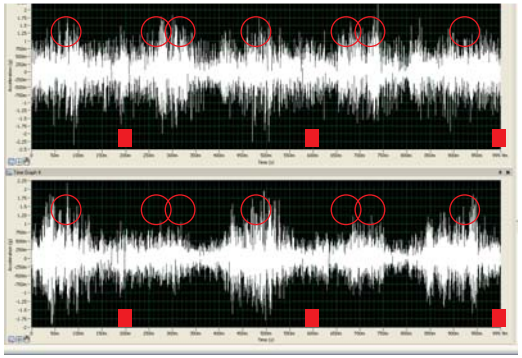
Anticipated Data and Testing

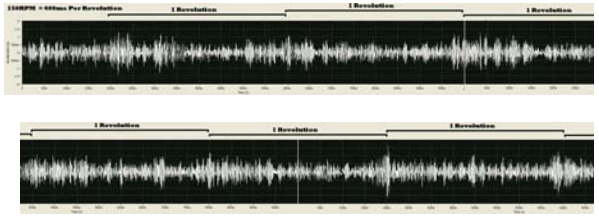
The group anticipates that the accelerometers will give information of the frequency of the spindle. The group anticipates that LabView will analyze this data from the accelerometers. From this data, the group hopes to conclude the frequency at which a carbide insert will break off of the face mill. It is expected that the lab results will match the machinery results, as far as being able to see a frequency where the carbide insert breaks

Trial 5.1.3
Analysis

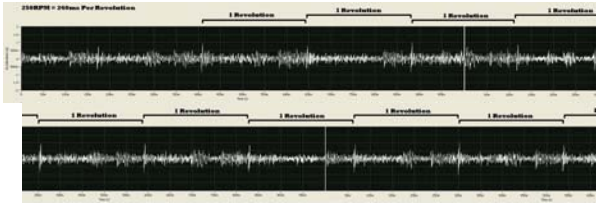
Date & Time	Oct 21, 2009 15:51
RPM	150
Feed Rate	5.75
Depth of Cut	0.035
# of Broken	3
Material Size	3.99
Start	15:47:35
End	15:48:30



150RPM =400 ms per Revolution



250RPM =240 ms per Revolution



How The Expected Results Will Be Incorporated In A Proposed Solution

Small scale testing will be done at IIT, in a setup similar to the one used at Finkl. This will determine the feasibility of our testing.
If successful, we can determine a insert detection methodology to present to Finkl.

Dominant Frequency

It has been noticed that there is no dominant frequency or attribute that is created or noticeable when there are broken teeth compared vs none broken teeth. The data supports that using the Power Spectrum to isolate the frequencies for the overall frequencies being transmitted to the accelerometers there is nothing dominant between the runs. Frequencies change drastically between machines and even between some variables being changed.

Conclusion

These conclusions were arrived at after rigorous testing on both a Bridgeport mill as well as a CNC Mill; the testing procedure and results have been provided prior to this section. The conclusions are as follows:

1) There is a regular, observable interval where each tooth makes contact with the metal. This contact time is seen as a spike in the time domain readings of the accelerometer
2) The amplitude of these spikes apparently depends on feed rate, rpm, and the depth of the cut.
3) Upon adding broken teeth, it is possible to observe two things. First, there is a clear difference in the PSD of the accelerometer readings when teeth are broken. Second, the amplitude of the spikes caused by the broken teeth in the time domain is noticeably different from that of the frequency domain. This, therefore, allows us to note when cutting inserts fail.

It must be noted, however, that the best results were obtained while performing tests on the CNC mill. This is because the CNC mill creates the least amount of extraneous vibration, which in turn registers as massive noise in the accelerometer readings. Moreover, further noise is added to the signal if 'scale' exists on the block being milled.

IPRO It takes a team! INTERPROFESSIONAL PROJECTS PROGRAM

IPRO 304

Integration of Process Improvements

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Sponsor : A Fincl and Sons

FINKL
A. FINKL & SONS CO.

ILLINOIS INSTITUTE OF TECHNOLOGY
Transforming Lives. Inventing the Future.

Team Purpose and Objectives

1. Team Purpose

The goal and mission this semester is to create a procedure that can show a technician when a carbide insert breaks off of a face mill during operation. Completing this task will increase productivity for A. Finkl and Sons.

2. Team Objectives

The objectives are to create a computer program, create a test plan, implement this procedure test plan in a lab and at Finkl, make the project cost-efficient, and ensure it is known when carbide inserts break off the face mill.

Background

1. Information About The Sponsor

A. Finkl & Sons Co. was founded in 1879. Finkl is the world's leading supplier of forging die steels, plastic mold steels, die casting tool steels and custom open-die forgings, processing 100,000 tons of steel each year. Since the 1800s, Finkl has maintained a commitment to manufacture 100 percent of its products in Chicago. These products are distributed domestically and to more than 18 countries worldwide. In recognition of Finkl's product quality, Finkl was the first integrated steel manufacturer in America to receive ISO 9000 certification.

Background

2. Information About the Mechanical Failure

Since Finkl processes steel, they need quality control check each piece of steel. One of the machines takes the top layer off of the metal using an 18-inch faceplate with 18 carbide inserts. These carbide inserts take off ¼ inch of metal. Sometimes the carbide inserts break due to stress and the shape of the metal. Each machine has an assigned technician who will stop the machine and fix the carbide inserts. However, sometimes the technician does not realize right away that the carbide insert is broken. It may take three or four carbide inserts before it breaks when the technician replaces the broken carbide inserts. The steel that is going through will need to be reprocessed as a result. Another facet is that the technicians have to wait on the steel going through the machine. This means wasted man hours watching the metal go through, instead of doing something more productive for the company.

Ethical Issues

The cost implications are significant for this issue. This project aims to reduce human error which, in turn, would increase productivity. Finkl has asked IIT to help them with this problem and this IPRO will conduct this project solely with Finkl.

Practical Methodology

The approach to this project is to attach an accelerometer (an object that measures acceleration) and measure the change in the amplitude of certain frequencies as time progresses. When the amplitude changes, due to a broken carbide insert, the machine will be stopped the carbide insert will be replaced. The group anticipates that the frequency change will be great enough to show when the insert breaks.

The main focus will be to find out how to calculate when a carbide insert has broken off of a face mill. Other main tasks are finding out how to measure the frequency of the accelerometers and conducting the experiments. The group will first figure out the test plans for the Electrical Design group and for the machining group. Then the group will test the procedure and collect data. After analyzing the data, the group will know if the procedure and the instruments can identify the broken carbide insert. The solutions will be graphical, so it will be easy to find out if the broken carbide insert can be seen. It is very possible for the group to finish the tasks at hand and have results by IPRO day.