Sponsor : A Fincl and Sons

FINKL
A. FINKL & SONS CO.

2009 Fall Semester

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Machining Team:
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- o Erik Gruchalski

Advisors:
Prof. W. Maurer
Prof. S. Mostovoy

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

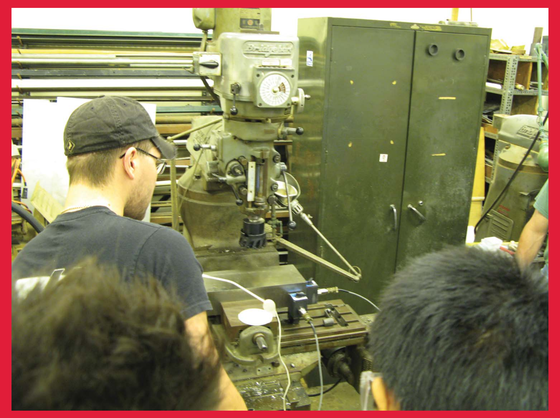
The objectives are to create a computer program, create a test plan, implement this procedure test plan in a lab and at Finkl, make the project cost-efficient, and ensure it is known when carbide inserts break off the face mill.

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.

BUSINESS COSTS OF PROBLEM

The costs associated with solving this problem are minuscule compared to the costs each year due to this problem. This method will be saving them money because instead of three or four carbide inserts breaking before finding the problem, only one carbide insert will break.

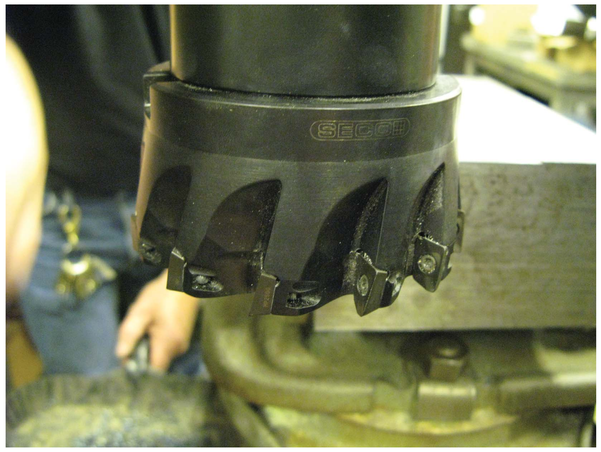


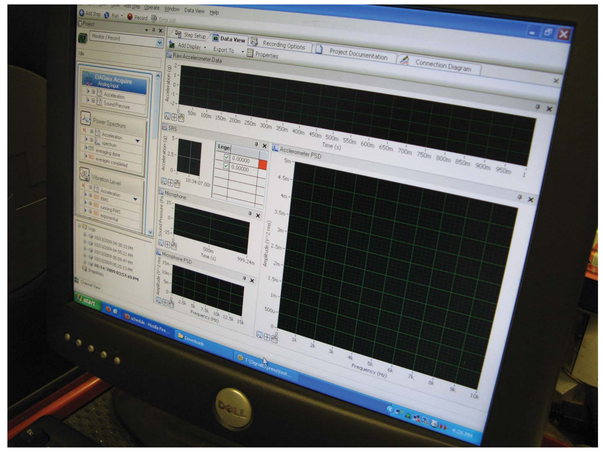
IPRO It takes a team!
INTERPROFESSIONAL PROJECTS PROGRAM

IPRO 304: Integration of Process Improvements

PROBLEM SOLVING TECHNIQUES

The main focus is to determine how to calculate a carbide insert failure. Other tasks are determining how to measure the frequency of the accelerometers and conduct the experiments. Analysis of the data will show know if the experimental procedure and the instruments can identify the broken carbide insert.



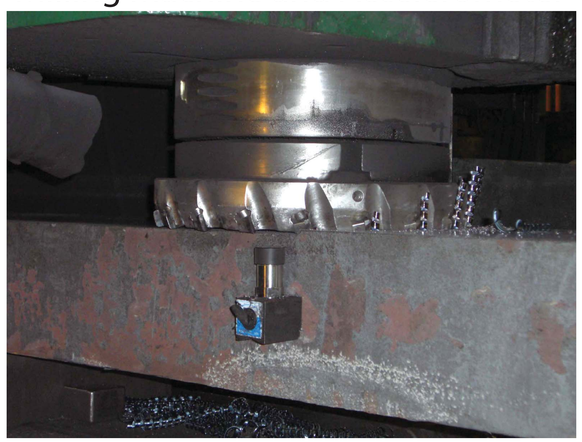


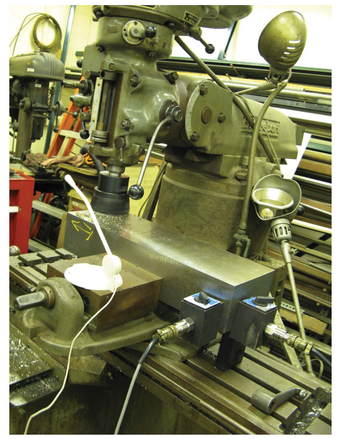
PRACTICAL METHODOLOGY

The approach is to attach an accelerometer that can measure the changes both in time domain and frequency domain. The RMS value of the signal in time domain will be monitored, while the power spectrum density is used for frequency domain analysis. When the data indicates that there are teeth broken, the machine will be stopped and the broken teeth replaced.

A broken Tooth

Milling Machine and Accelerometer





BACKGROUND

1. Information About The Sponsor

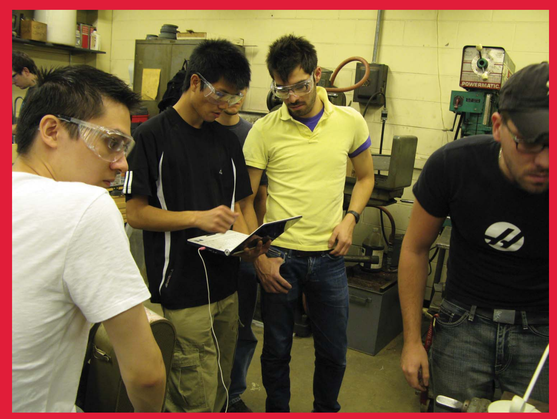
A. Finkl & Sons Co. was founded in 1879
- One of worlds leading steel mfg. Firms
- First to be ISO9000
- Fun fact: largest consumer of electricity in IL

2. Information About the Mechanical Failure

- Finkl approached IIT w/ a mech problem
- Milling machines w/ a cosmetic finish
- Machines have cutting inserts which fail and cannot easily be detected by human error
- Finkl does not have Comp controlled machines as well

3. Historical Investigation of Tool Failure

- Work on Accelerometers
- Acoustic detection
- Visual detection



DETAILS ON ANTICIPATED ACTIVITIES

The group experimented in a lab for the first half of the semester while they tested the program to figure out that they could see when the carbide insert breaks. The group hopes to find that the accelerometers can also discern the frequency at which a carbide insert breaks off. If the group is successful, the next step is to present in front of Finkl.

POTENTIAL OUTPUTS

The potential outputs from the first phase of testing are to create a test plan and have the analyzed data. The data will show the amplitudes of certain frequencies when the carbide inserts are broken. The output from the second phase of testing is to have Finkl's approval of the test plan and the analyzed data corresponding to the first phase testing.

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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

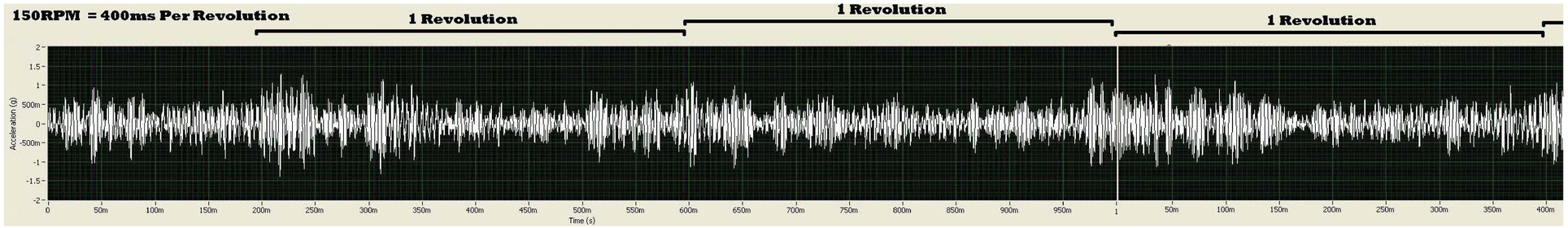
Summarize the Challenges, Risks and Assumptions

Process Challenges
- Find an appropriate accelerometer
  - High band width
  - Low G
- Detect Broken Insert

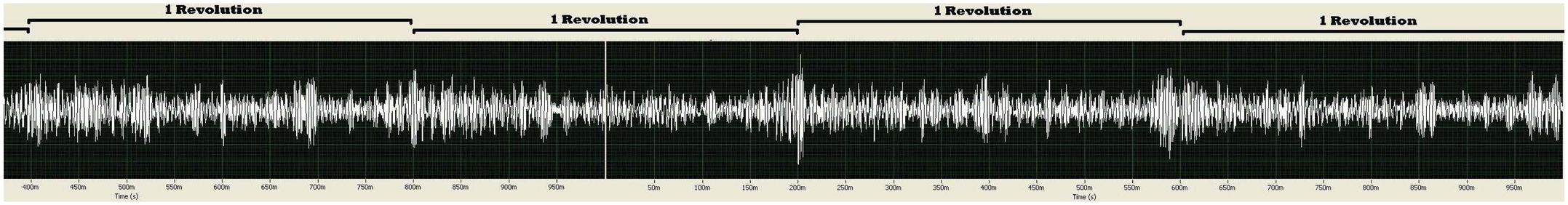
Safety challenges
- Steel projectiles
- Catastrophic insert failure
- Milling Injury Prevention

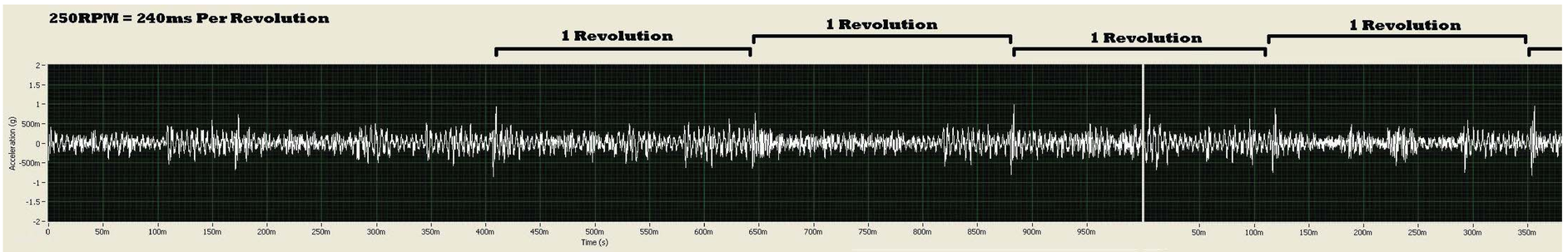
HOW THE EXPECTED RESULTS WILL BE INCORPORATED IN A PROPOSED SOLUTION

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.



150RPM =400 ms per Revolution





250RPM =240 ms per Revolution