

# Innovating Process Improvements in Manufacturing

*Spring 2009*



**IPRO 304**

INTERPROFESSIONAL  
PROJECTS PROGRAM

## Members

## Introduction

## Research Accelerometer

## Experimental Design

## Data

## Current Progress

## Questions



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# A. Finkl & Sons Co.

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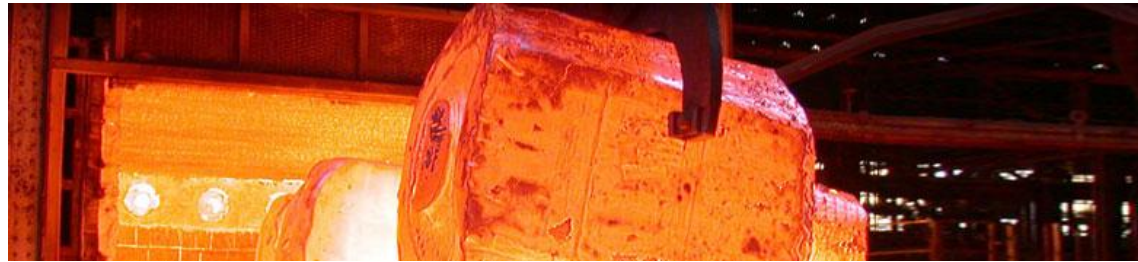
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Melting



Forging



Heat  
Treating



Milling Process



Finished Product

# Advancement Opportunity

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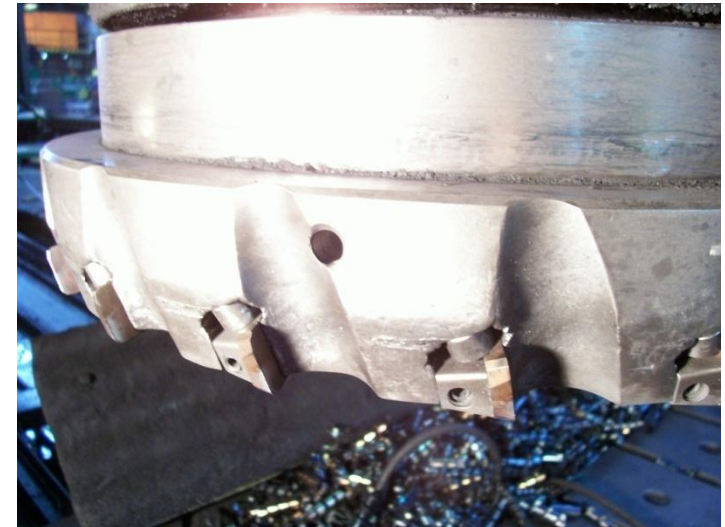
Future Progress

Questions



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- Milling machine (below) contains inserts broken during milling process
- From previous IPROs, the use of accelerometer has been proven to be the most effective way to detect broken inserts
- Provide A. Finkl & Sons with the proper data & statistics of which solution to invest in



# Objective of Current IPRO

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- Accelerometer used differently to measure vibrations
- Analyze data and result of fall 2008 IPRO 304
- Continue collecting and analyzing data to compare with last semester's result
- Better understanding how material of the work piece and cutting parameter affect the milling machine
- With a solid knowledge of behavior of broken inserts in term of acceleration, design a working prototype that automatically detects broken inserts and alerts the operator.



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# Techkor Accelerometer

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## Chosen Accelerometer Package Because:

- 0-50G acceleration range
- High Sampling rate, up to 40khz
- Wireless Transmission
- Automatically downloads data
- Hundreds of Accelerometers can be handled by 1 Access point.
- Maintenance Watchdog program can notify operator when a problem has occurred.



**MAINTENANCE  
WATCHDOG™**

# Experimental Setup

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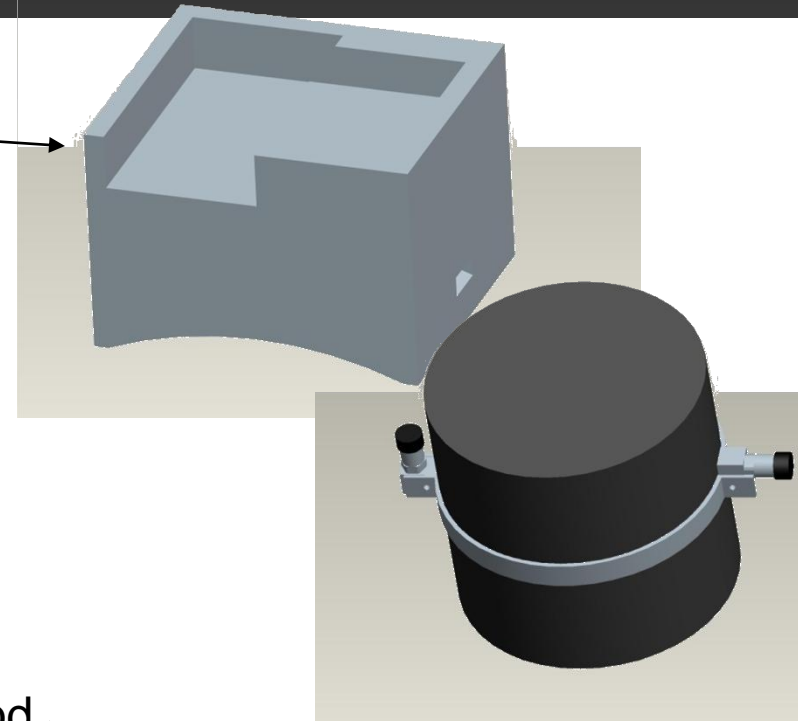
Questions



Spring 2008 mounting

- Many techniques were explored to mount the accelerometers to the area of interest

- As the requirements of the problem changed, the method was changed



Current method



# Signal Analysis

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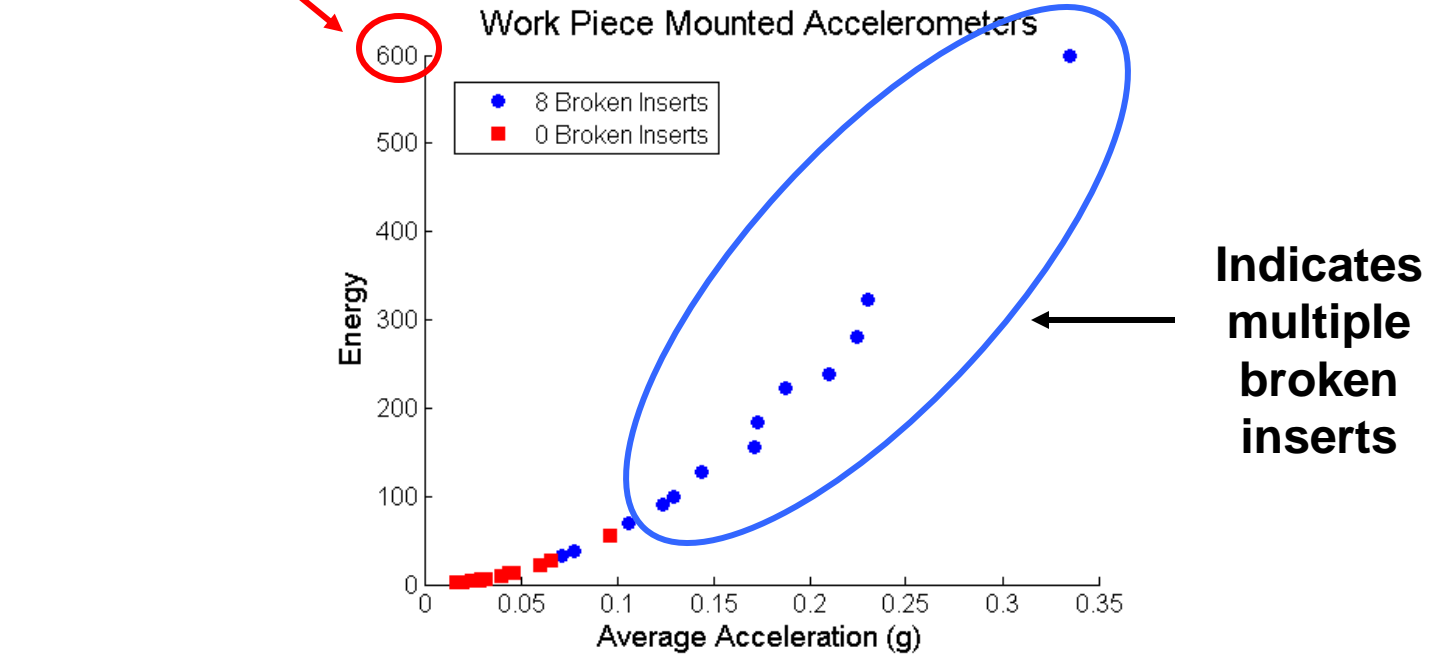
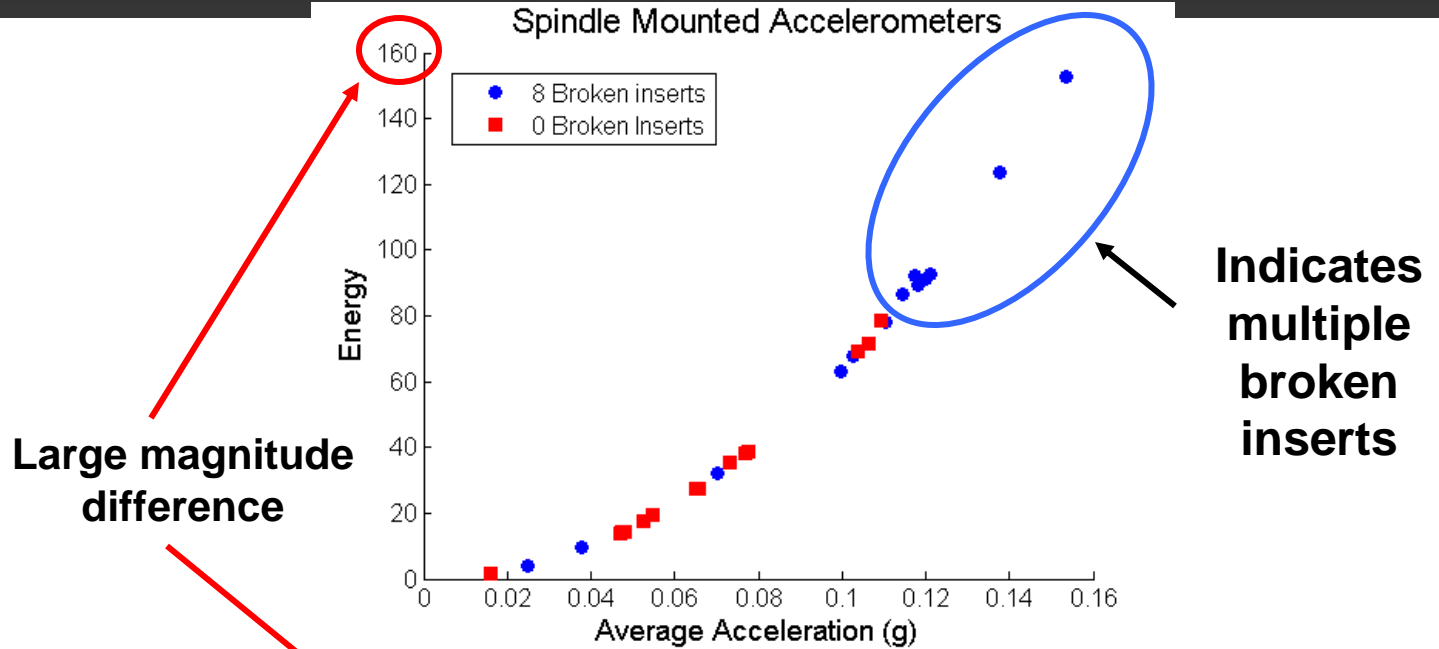
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- Revalidated last semester's approach
- Re-established relationship with Finkle
- Multiple data sets measured
- Working data parser
- Prototype data analyzer completed

```
1 -4.128507E-1
2 -6.231499E-1
3 -2.433790E-1
4 -1.932527E-3
5 6.253882E-2
6 1.056511E-1
7 1.288785E-1
8 9.815246E-2
9 4.801385E-2
10 8.321498E-3
11 -2.014895E-2
12 -3.696876E-2
13 -3.778816E-2
14 -2.976362E-2
15 -1.703683E-2
16 -2.530432E-3
17 9.309648E-3
18 1.298780E-2
19 1.159815E-2
20 9.491470E-3
21 6.789751E-3
22 -4.837122E-4
23 -6.436099E-3
24 -5.972001E-3
25 -3.288248E-3
26 -3.906566E-3
27 -2.087608E-3
28 4.460689E-3
29 5.920296E-3
30 -1.447388E-3
31 -3.852904E-3
32 2.713134E-3
33 5.895143E-3
34 2.141731E-4
35 -6.610400E-3
36 -5.017635E-3
37 1.575915E-3
38 4.190751E-3
39 2.288010E-3
40 -1.423550E-4
41 -8.576976E-4
42 -2.876191E-3
43 -4.498525E-3
44 -1.442315E-4
45 4.784434E-3
46 2.392468E-3
47 -6.890427E-4
48 8.753837E-4
49 2.041724E-3
```

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**Future Progress**

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- Increase data acquisition rate
- Discover algorithm for detecting broken teeth
- Configure software for more relevant results
- Collaborate with Finkl for integration of detection system



# Questions?

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**We would like to thank A. Finkl & Sons,  
Professors Maurer and Mostovoy  
and the IPRO office for all the support.**

**Thank You!**

**IPRO Team 304**

**Questions?**