What is the Purpose of IPRO 304?

The purpose of IPRO 304 is to develop a robust, working prototype that can automatically monitor and detect a problem with a milling machine at A. Finkl & Sons Co. Finkl wants us to concentrate on alerting management to the detection of broken teeth during machining so that the proper measures can be taken to replace the teeth.

This system will involve measuring vibrations using an accelerometer or by the use of laser detection. The goal of this IPRO is to research, test, and inform A. Finkl & Sons of the best solution to invest in, therefore they can decide which is better for their company.

To date, our IPRO team has done the necessary research to confidently test out accelerometers on the milling machines at Finkl. The team was split into smaller groups to carry out the goal of the project. After the research phase, we went into testing mode and ran several tests on the milling machines. We received a lot of data and we are currently in the process of properly analyzing it.

IPRO It takes a team!
INTERPROFESSIONAL PROJECTS PROGRAM

IPRO 304

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IPRO 304

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FINKL
A. FINKL & SONS CO.

What is an Accelerometer?

A. FINKL & SONS CO.

A. Finkl & Sons is the world's leading supplier of forging die steels, plastic mold steels, die casting tool steels and custom open-die forgings. Located in the heart of Chicago's Near North Side, their steel is distributed domestically and to more than 18 countries worldwide.

The problem that Finkl has is that of the detection of broken teeth on their milling machine. Milling machines are used to cut and finish metal. A rotating head on the milling machine has a number of inserts, also referred to as teeth, which cut the material as it rotates.

Currently, Finkl keeps an operator by the mill when it is running and they are in charge of turning off the mill when a tooth breaks. There is no proper form of checking for broken teeth, only by checking the material for unusual marks. This form of checking is too long, because most mistakes will not be noticed. If it is not fixed or noticed in time, it causes strain on the milling machine, therefore causing more teeth to break as well. By finding a solution to better detect when an insert breaks, it will save Finkl much time and money, enabling them to manufacture more quantity of pieces and better quality. Finkl spends about 125 minutes a day checking/fixing teeth and approximately $200-$250 a day in losses.

Accelerometers

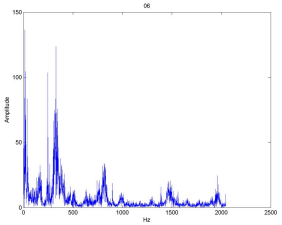
The main idea behind the accelerometer is that it is a device that measures vibrations. With this we concluded that if we measured vibrations from the milling machines we could see in the data the spike in vibrations due to a tooth breakage. The accelerometer could be attached to the head/spindle of the milling machine and record data.

After conducting research on several accelerometer types, we decided to order a wireless accelerometer from Techkor. The accelerometer is a wireless method of transmitting CBM vibration data in industrial environments. The unit contains a precision piezoelectric sensor, temperature sensor, digital signal processor, data memory, wireless transceiver, internal battery, and an internal antenna. The accelerometer collects and transmits vibration data securely via a wireless link. The data collection parameters are configured from a networked Windows PC. Data in Gs, ips, or mils can be in the form of time trace or FFT and thousands of units may share the same radio network to Ethernet network.

Collecting Data/ Testing

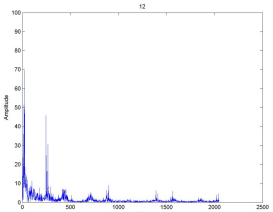
The vibrations that are emitted by the milling machine and the work piece vary depending on the location. This is due to the moving parts generating different vibrations and depending on the distance from the source of the vibrations, the intensity of the vibrations change. By placing the accelerometers in different locations, the accelerations seen at the location will vary considerably. Also, depending on the orientation of the accelerometers, the accelerations in that direction will differ. By trying different orientations and locations of the accelerometers, we were trying to find a location that will show us distinctly when a tooth is broken.

By plotting the information obtained from the accelerometers in a Fast Fourier Transform (FFT), the frequencies of the acceleration can be analyzed. By looking at different portions of this FFT, we hope to find a difference in the frequencies experienced when a tooth in the milling machine breaks.



<— Here is an FFT chart taken when tested with 8 broken teeth. There is an abnormal spike in data recorded.

Here is an FFT chart taken when no broken teeth were present. —>



FFTs