

## IPRO 304-1 Project Plan

### Objectives:

The purpose of this IPRO is to develop a system to automatically detect a problem with a mill at A. Finkl & Sons Co. The system will either turn the mill off or warn the operator when a tooth breaks, or some other irregularity occurs. This system will involve measuring vibration, and sound. Photos will also be taken for surface analysis. This will replace the current setup, which involves an operator staying in close proximity to the mill to turn it off when a tooth breaks or any other irregularity occurs.

### Background:

Milling machines are used to cut and finish metal. A rotating head has a number of teeth that cut the material as it rotates. The material moves under the mill so the entire surface can be milled. The mill being used for this project is used to improve the surface finish of large forged steel parts.

Finkl currently keeps an operator by the mill when it is running, and that person will turn off the mill if a tooth breaks, or some other problem occurs. That person's time would be better spent operating several machines, rather than sitting by one waiting for a tooth to break.

### Plan:

Several member of the IPRO are tasked with researching current methods of automatically turning off milling machines.

Finkl will purchase a camera and microphone of our choice as well as a computer and data acquisition card to collect the data, and an accelerometer.

The data from the accelerometer, and microphone will be analyzed and undergo signal processing. A video camera will be used as a reference to know when the signals are "normal" and when a problem has occurred. Photos will also be taken of surface finishes during the milling process to be used for FFT analysis. Based on this information, thresholds can be set. When the signals are out of the normal operating range, either an alarm will sound, or the system will be turned off.

Since our progress is largely dependent on Finkl's cooperation and the delivery of our equipment, a schedule cannot be made at this time.

### Project Budget:

This IPRO will require the purchase of a microphone, camera, and power meter. Signal processing software may also be necessary. Exact values are not yet available, but Finkl

will be responsible for purchasing the equipment. Anything Finkl cannot supply will be purchased out of the budget. Also, every attempt to use the resources of IIT labs will be made before the purchase of any equipment.

Expected Results:

The mill vibration, and noise will vary when a tooth is broken. One or more of these variables will be monitored. This IPRO will result in a system that determines when the mill is outside normal operating conditions.