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INTRODUCTION

A Finkl & Sons Co. is a world wide provider of steel parts. A very important step in the manufacturing of steel is the milling of steel, in order to achieve the desired dimensions of the part. The cutting in the mill is done by small Tungsten Carbide composite milling teeth. During normal operation of the mill teeth break, leading to a bad surface finish.

OBJECTIVES

- Our objective is to develop an Early Warning Detection System that will allow us to recognize the presence of a broken tooth during machine operation.

METHOD

- Accelerometers collect the data under a variety of testing parameters in order to acquire thorough data.
- Thorough testing must be conducted to ensure the accuracy of the test results so that the detection methods utilized will be most representative of the actual conditions under which teeth are broken.
- The final broken tooth detection product must be of feasible design with proven useful application, and operated in a relatively simple manner.

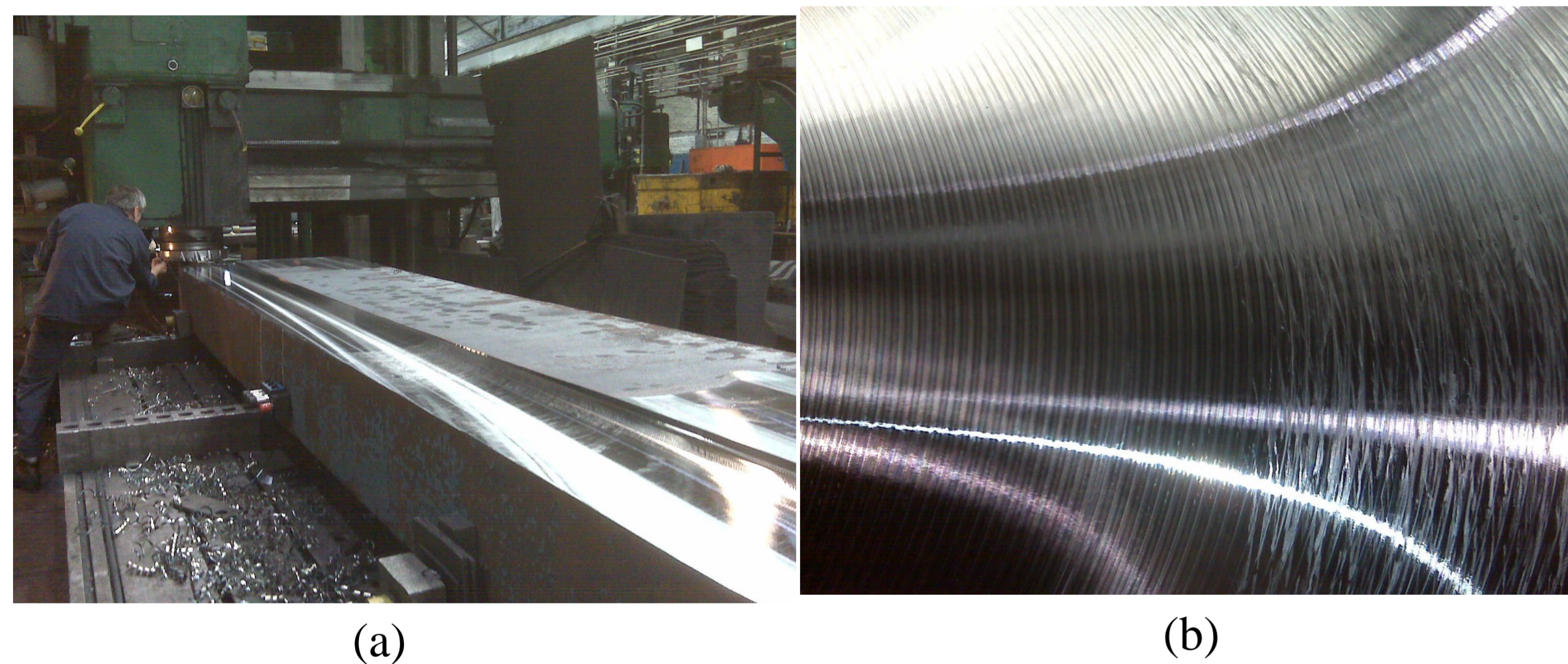


Figure 1.

- (a) This shows obvious distinction of cutting with broken teeth. Smooth and mirror like surface is the result of cutting without broken teeth, and scratched surface is the outcome of cutting with broken teeth.
- (b) This picture reveals more accurate difference between cutting with non-broken and broken teeth.



Figure 2: Slightly chipped tooth



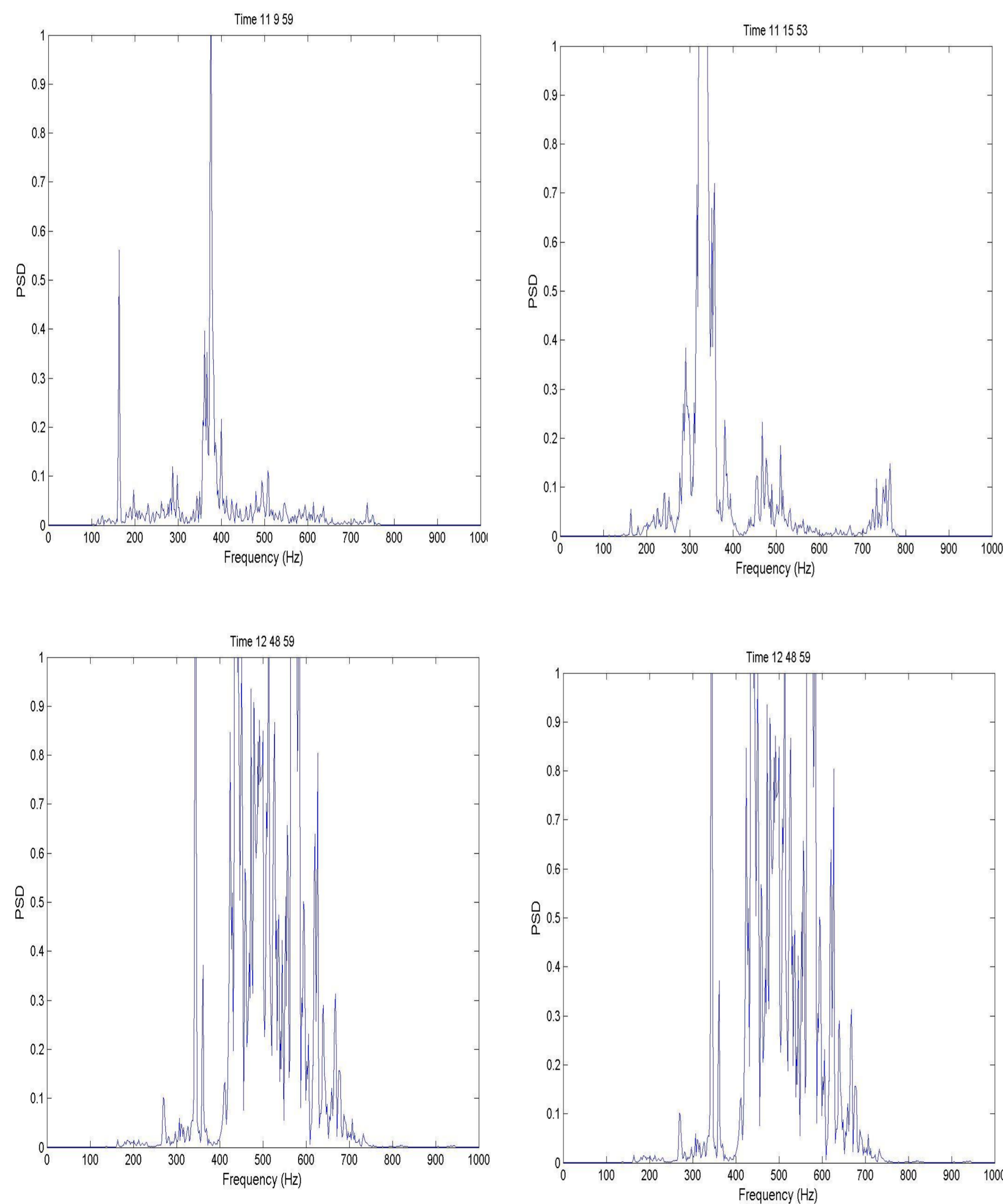
Figure 3: Accelerometer placement during milling process.

Innovating Process Improvements in Manufacturing

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Data Analysis

A. IPRO 304 has found that the best solution is to use the wireless accelerometers from Techkor to measure vibrations. It is possible to gain accurate data from the accelerometers and put it in diagrams to read results accurately.



Result and Discussion

A. Due to the increased noise and vibration imparted on the work piece when teeth are broken as opposed to the case when teeth aren't broken, the frequency spectrum will become broader. In other words, higher amplitude values will be observed across a variety of frequencies.

CONCLUSION AND FUTURE WORK

The application of this system would rely on periodic acceleration curve plotting and analysis to obtain frequency spectrums. The frequency spectrums would then be analyzed through a program that would determine whether characteristics of the spectrum are within the realm of the output correspond to broken teeth. The future work lies in development of a prototype as described above.

