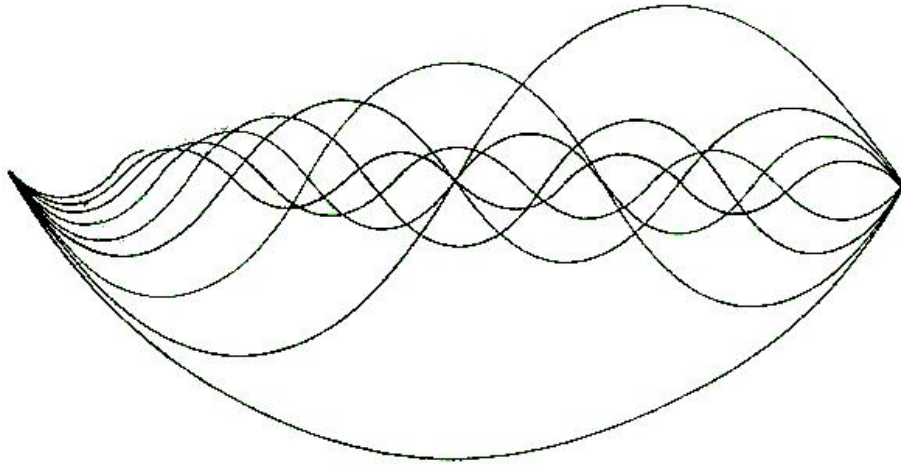


Active Automobile Vibration Analysis

Aaron Sacks
Meharban Sobti



Concept



All rotating machines vibrate at varying frequencies. Harmonics of these signals are unique to specific faults occurring in the equipment.



Implementation



2001 BMW 530i



Implementation



The vibrations from the un-tuned engine were measured and recorded at 5000 RPM using the tri-axial accelerometer.

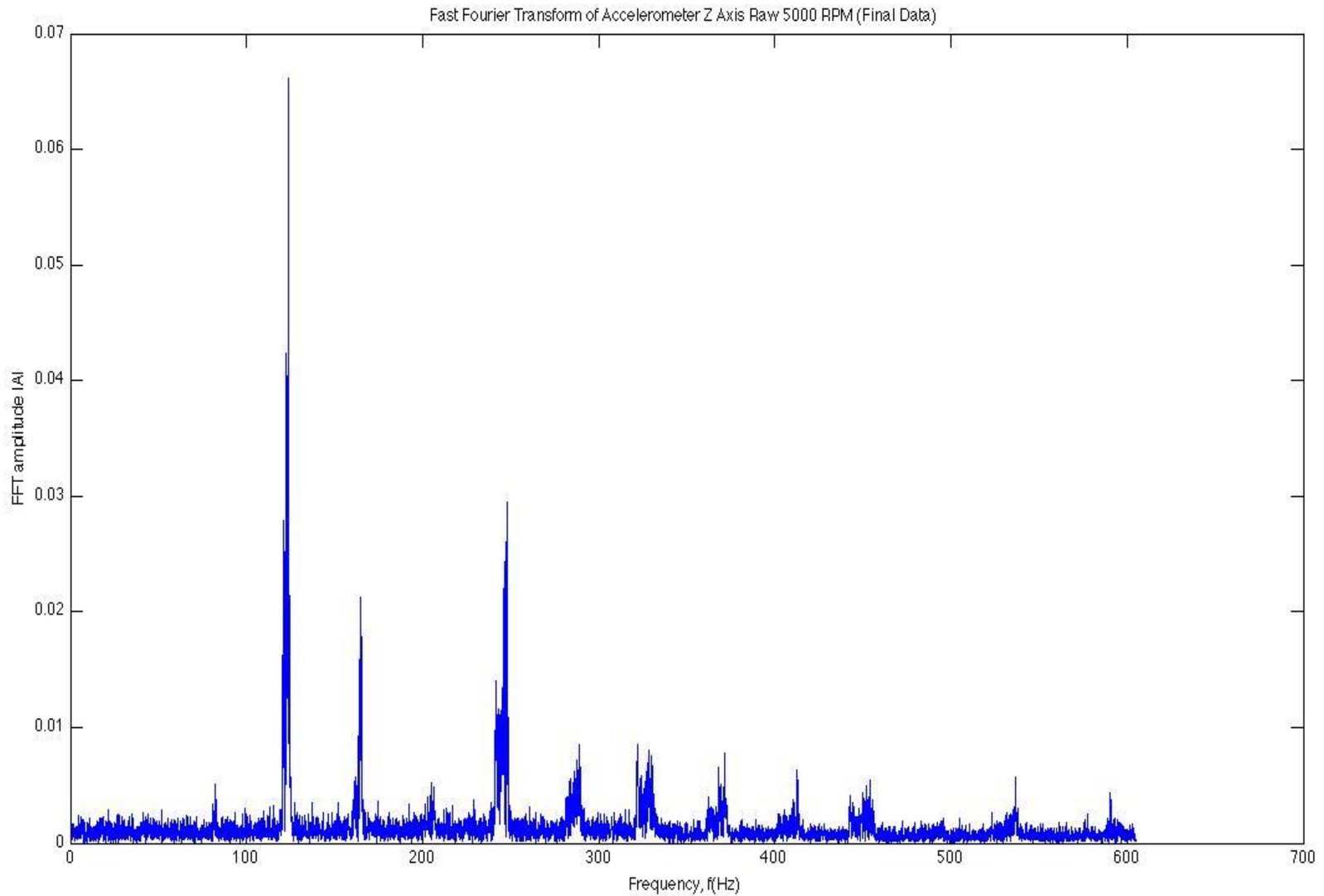


Implementation

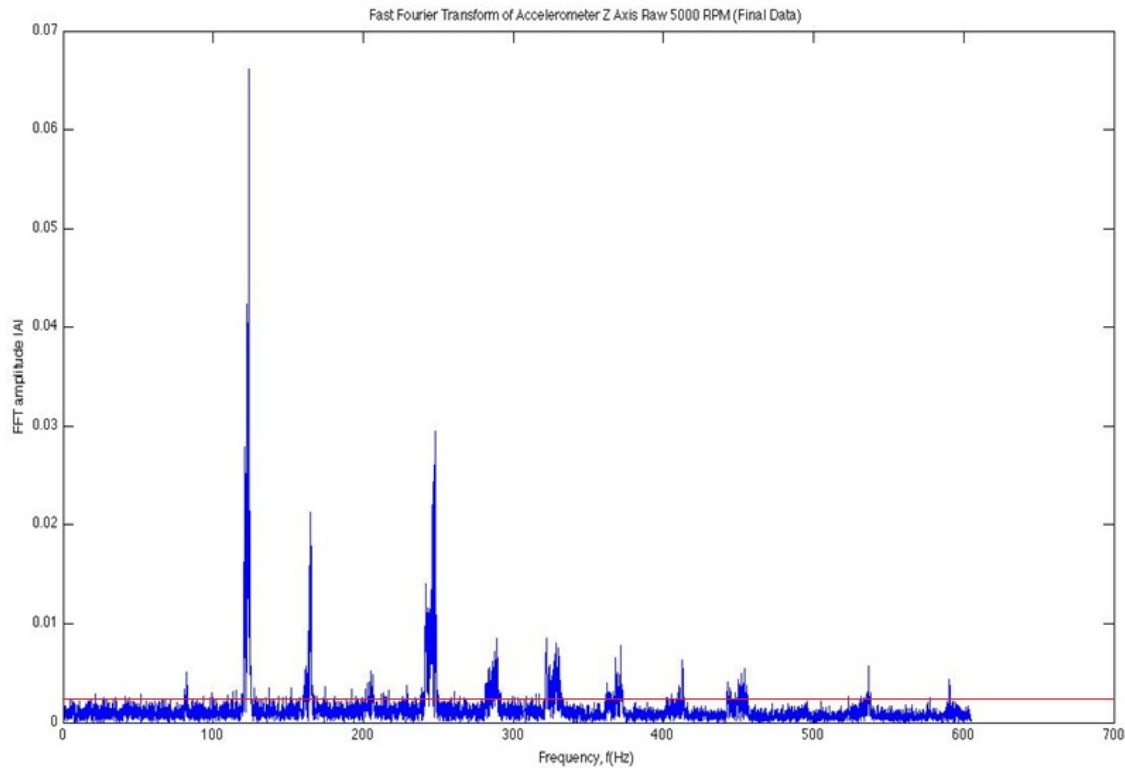


The car was then tuned. Vibrations in the tuned engine were recorded and a baseline frequency signature was then developed.



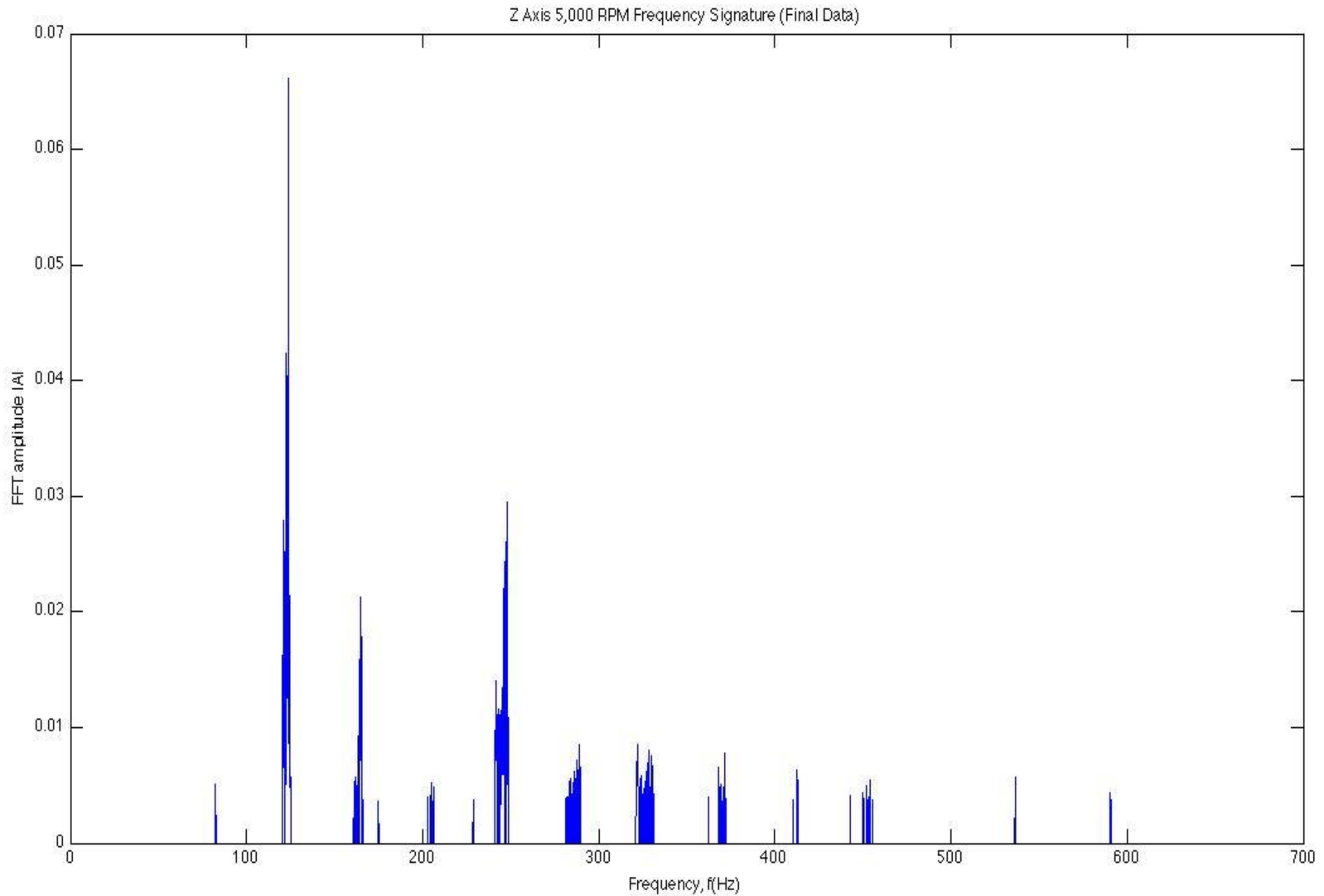


Analysis



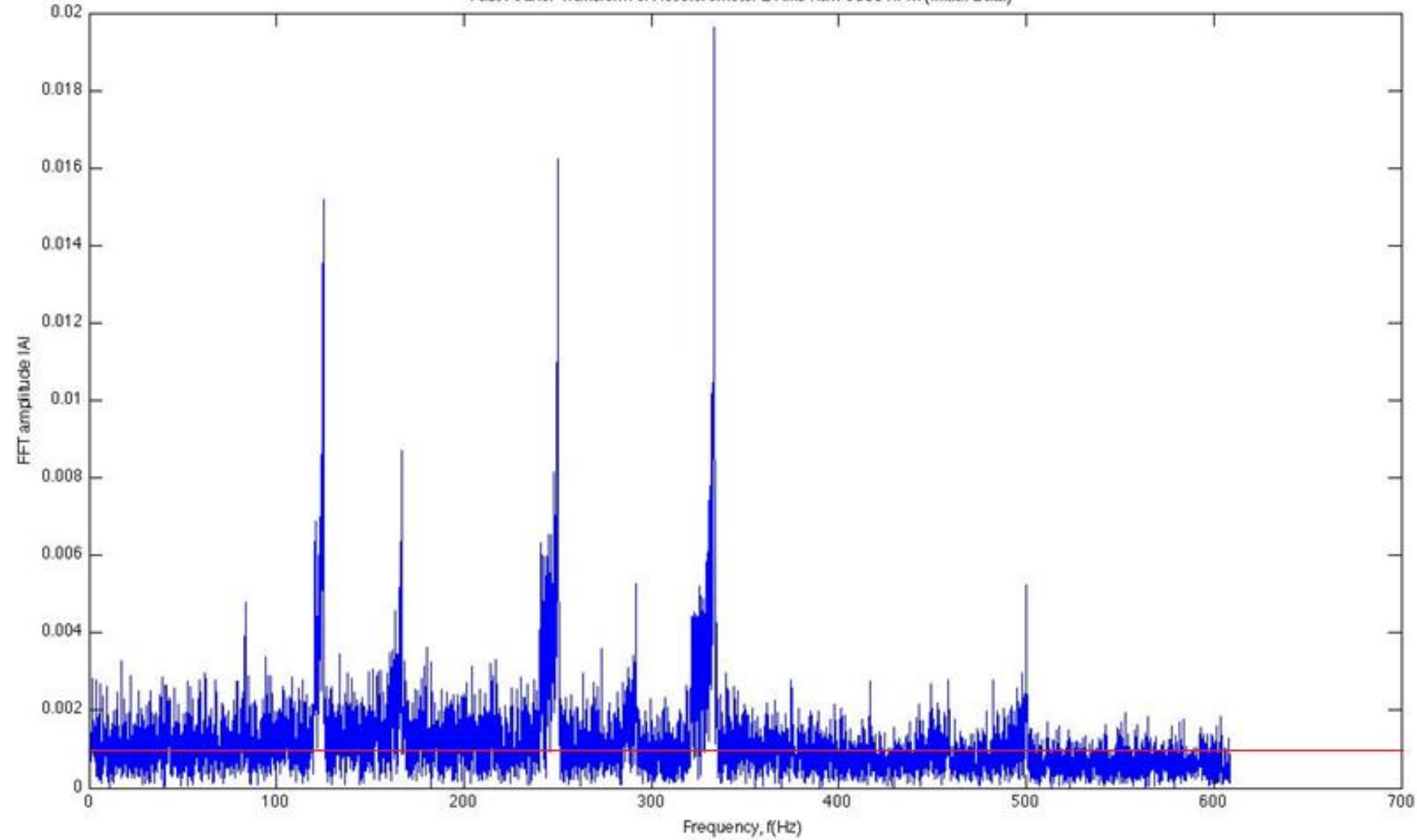
Cut-off Amplitude
= Peak / 18.3667

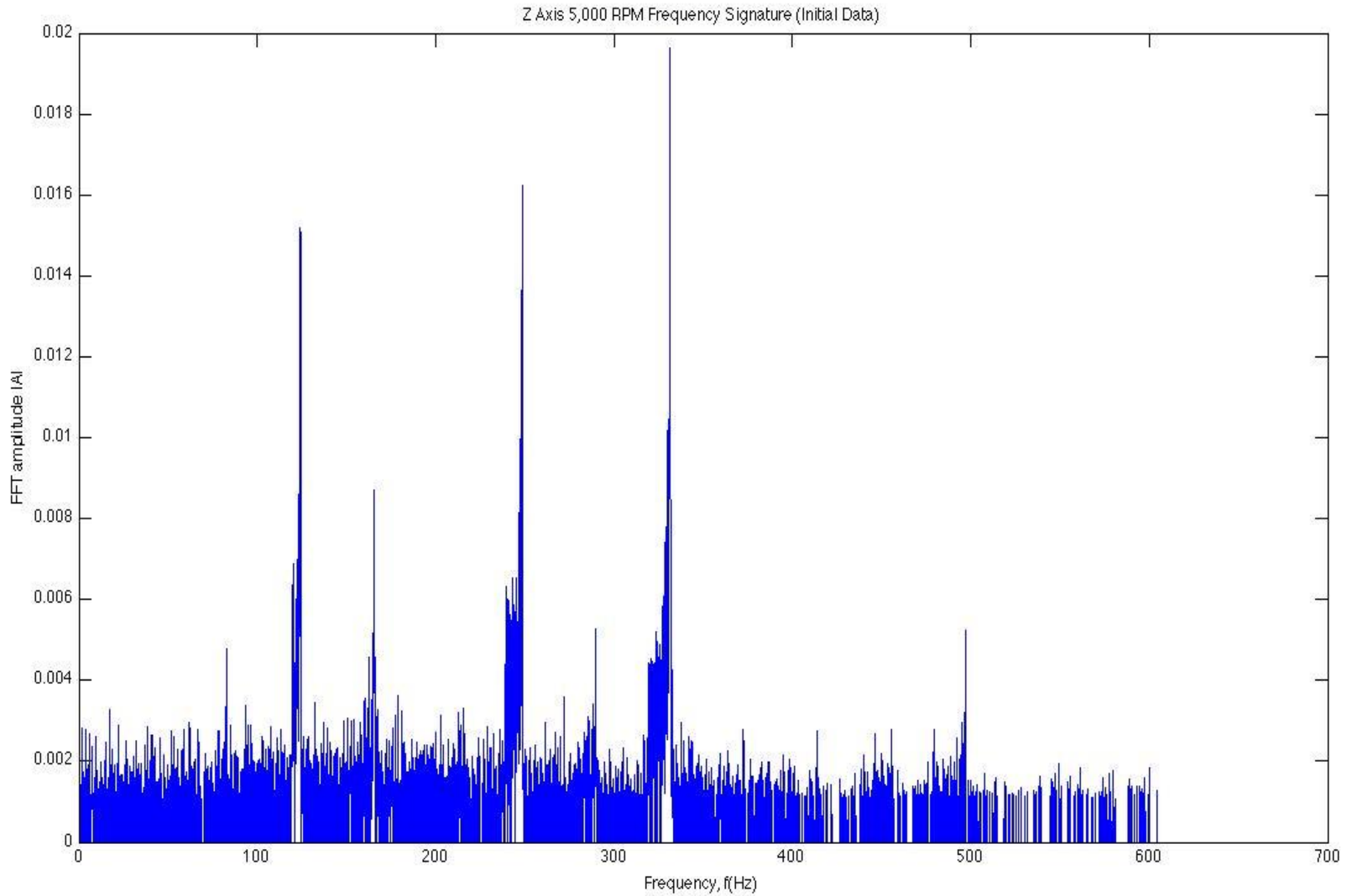




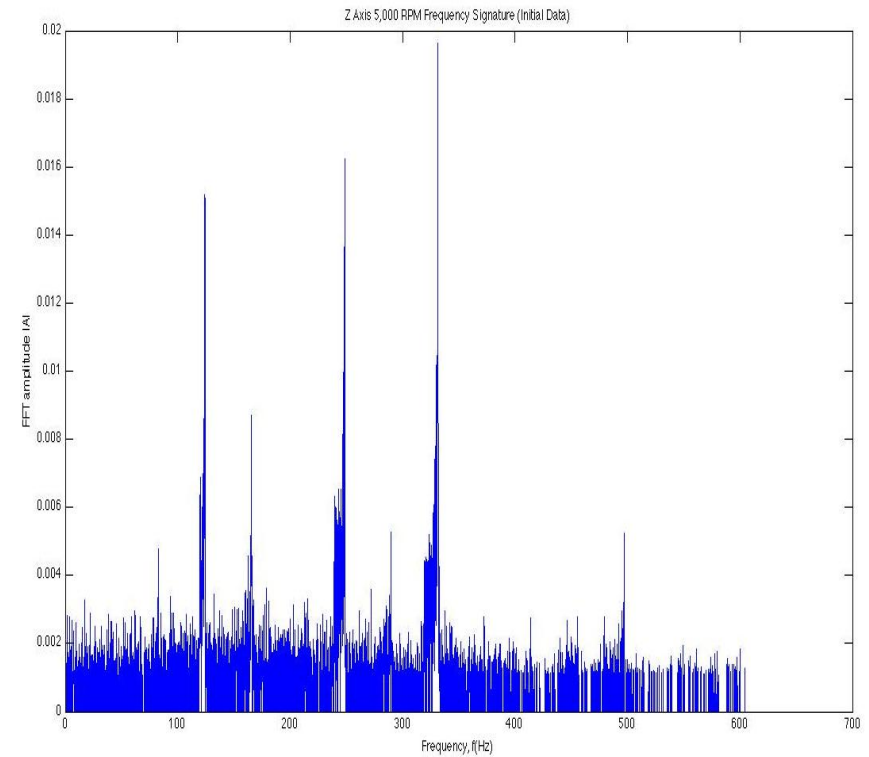
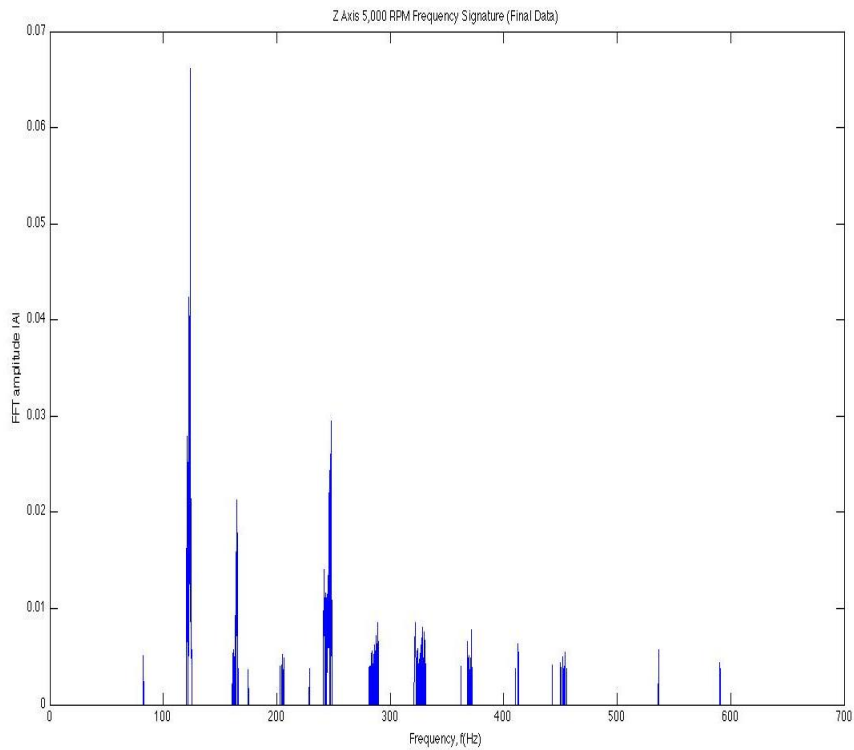
Analysis

Fast Fourier Transform of Accelerometer Z Axis Raw 5000 RPM (Initial Data)

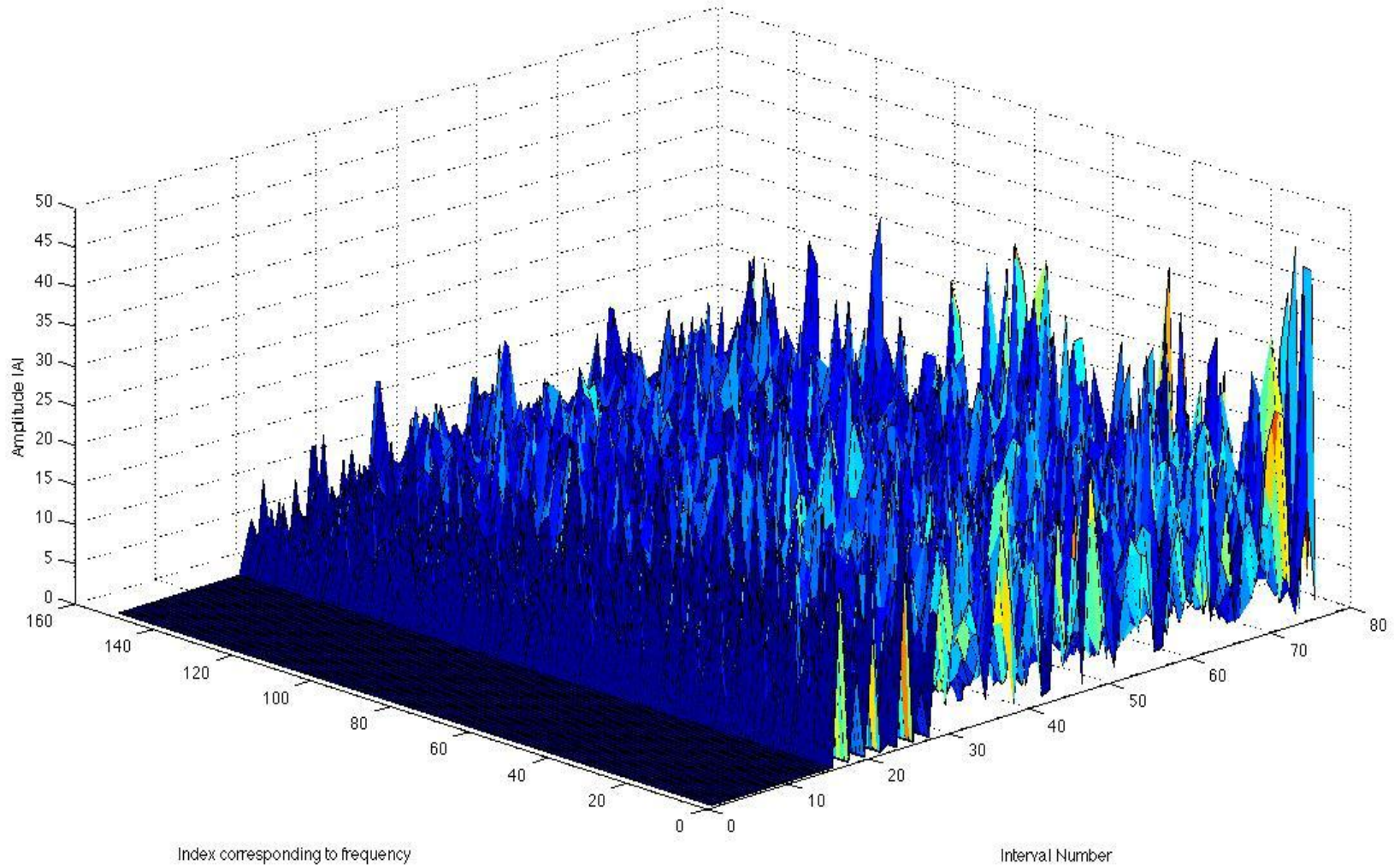




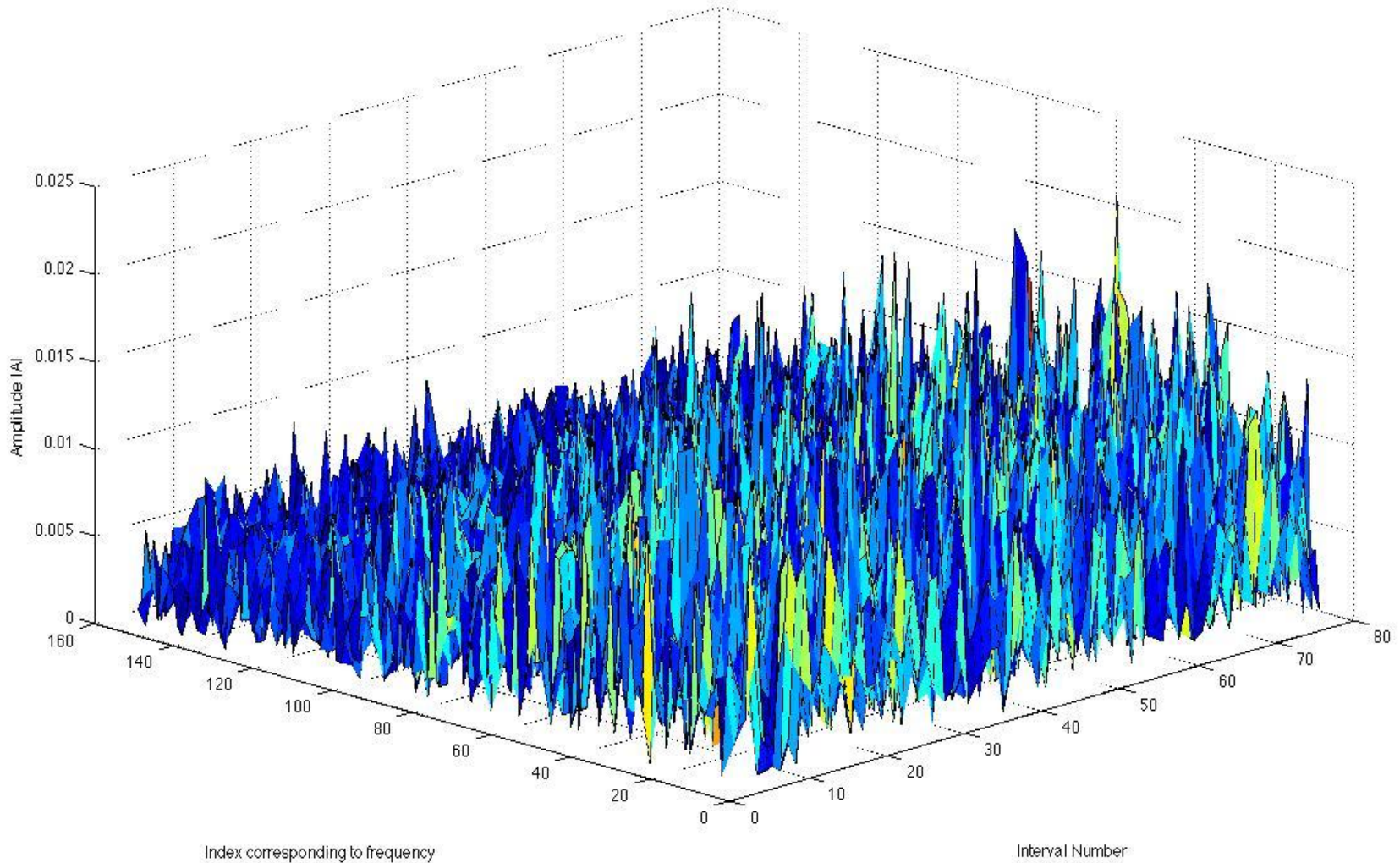
Comparison



Semi-Recursive FFT Surface of 10 MPH Raw Data Initial taken at 0.2645 Second Time Intervals



Semi-Recursive FFT Surface of 10 MPH Raw Data Final taken at 0.2645 Second Time Intervals



Current Installation

1. Tune the vehicle
2. Hard mount the accelerometer
3. Wire the harness through the firewall
4. Record the baseline data (vibration)
5. Determine the optimal peak to noise floor ratio
6. Set the sensitivity
7. Run the program



Further Development

1. Software needs to be able to identify frequency signatures of specific engine faults
2. User interface must be simplified so that it prompts only for make and model of vehicle
3. Software needs to be able to identify frequency signature of specific makes and models
4. Must integrate program with "Dongle" driver so that real-time analysis is possible



Marketing

1. First target client base is performance engine enthusiasts
 - Will provide needed exposure to general population
2. After being established, can pursue general market entry



Distribution

1. Aftermarket navigation systems
2. Will require professional assistance to penetrate vehicle firewall

