

PHYSICS 406

Investigating Infrasound Levels from a Single Wind Turbine

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Introduction

Wind turbines are one of the most common forms of renewable energy generation in use today, and are seen as a way to combat the effects of global warming by eliminating the planet's dependence on fossil fuels. Because of their positive environmental impact and effectiveness at producing energy, wind farms have been constructed across the world, where many turbines can be seen dotting the countryside. People living near these turbines complain of suffering from a condition known as "Wind Turbine Syndrome", which causes nausea, lack of sleep, feelings of unease, and dizziness, among other things. The source of this syndrome appears to be infrasound, a sound of frequency below human hearing. While the effects of infrasound on the human body are still being researched, there is a link between infrasound and the effects described. In addition, it has been found that wind turbines produce high levels of infrasound. The goal of our experiment was to verify that a single wind turbine does indeed produce infrasound, and measure this sound level experimentally.

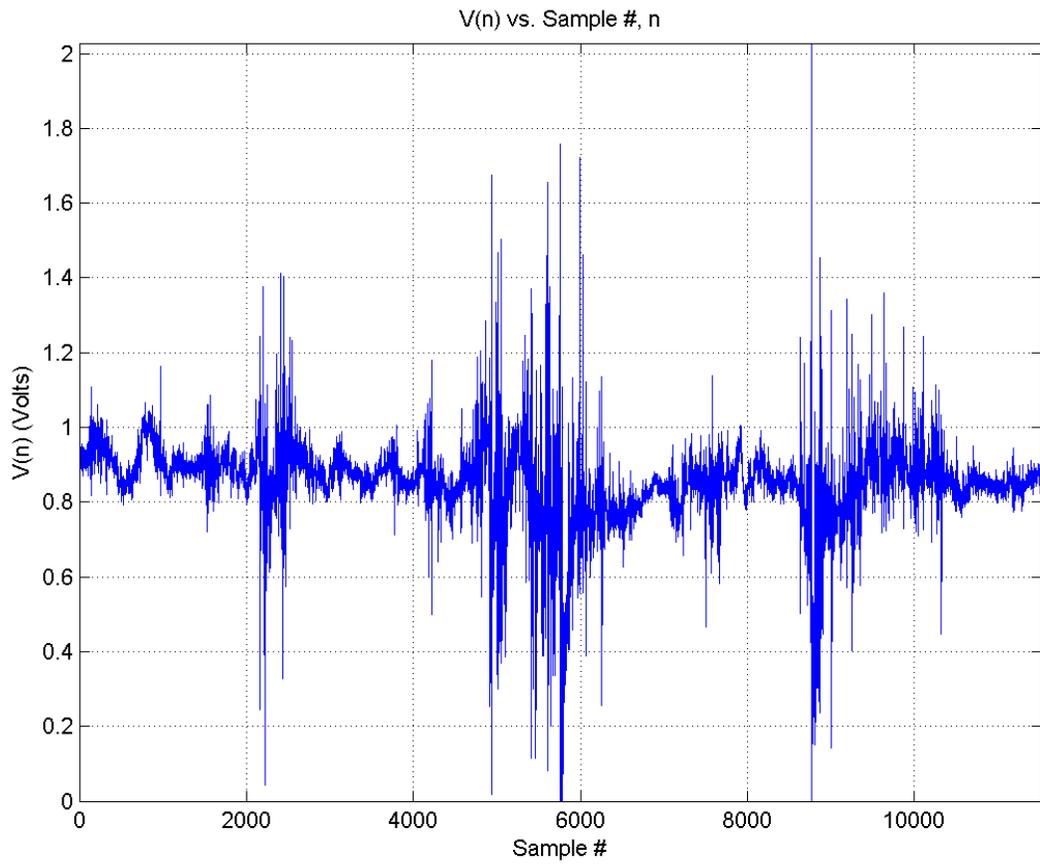
Data Collection and Equipment

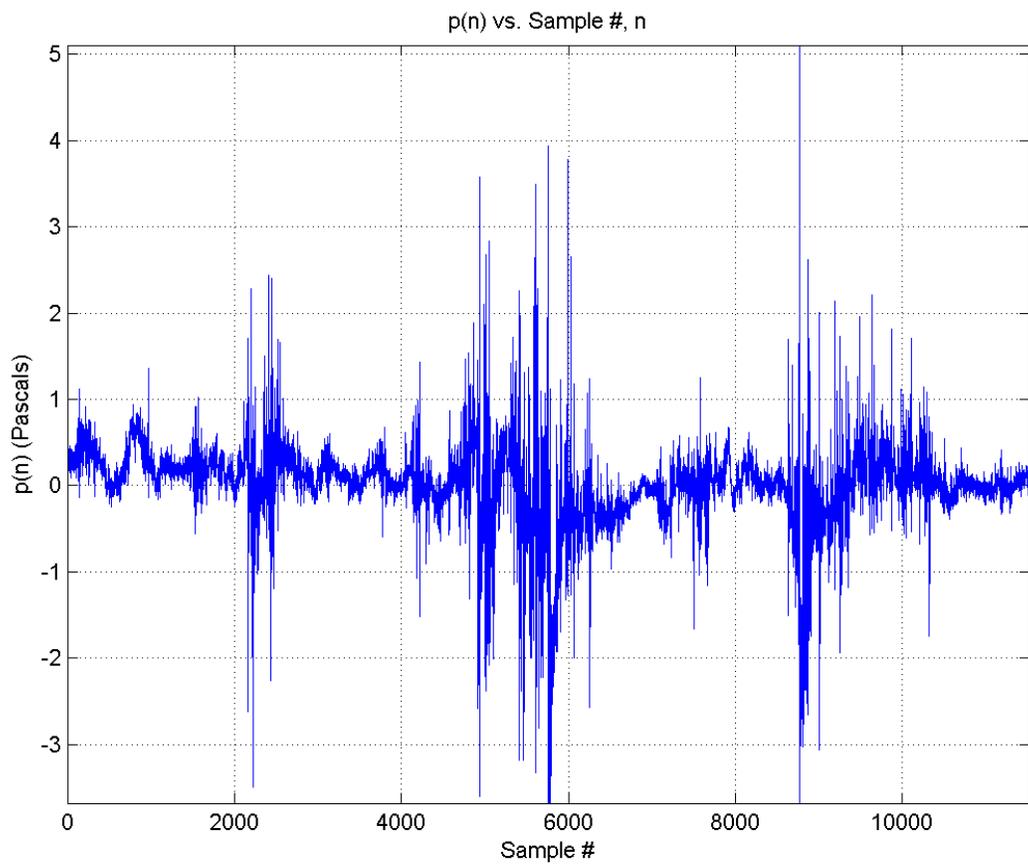
To get to a wind turbine we traveled to Mahomet. Three trials were performed. For the first trial the very sensitive microphone was placed outside of the vehicle and data was collected for approximately two minutes. The second and third trials collected data for approximately three minutes and both were performed with the microphone inside of the vehicle. To be able to measure the low frequencies out in the field, the IOLab system was used. The IOLab unit is able to communicate wirelessly to a USB attached to a lap top using 2.4GHz ISM band. The Unit acquired and sent data from the microphone to the computer in real time.

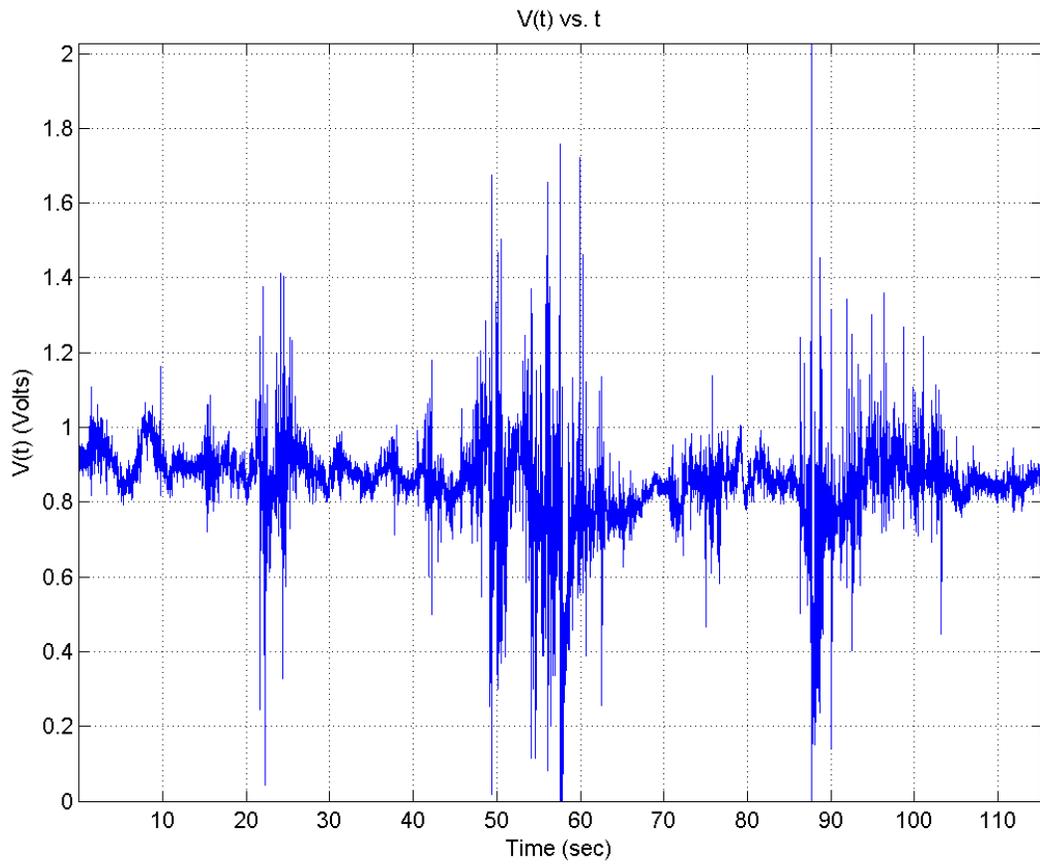
Data

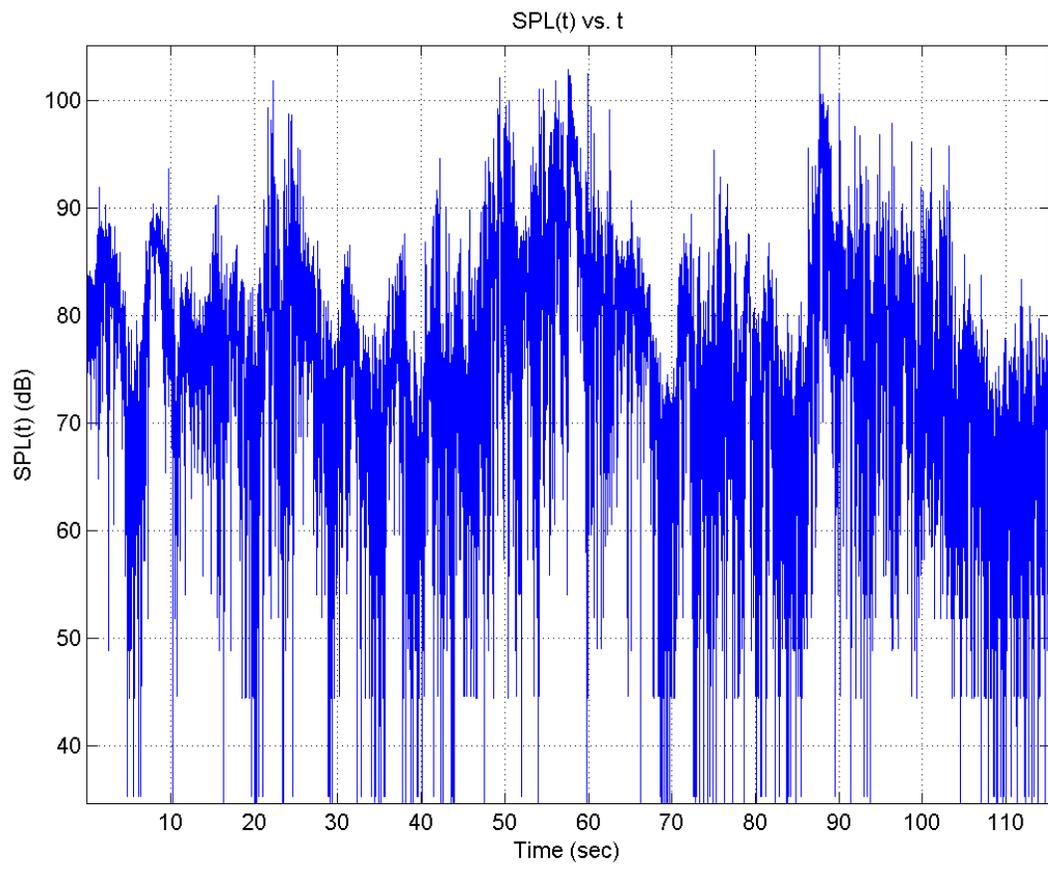
Due to windy conditions and ambient noise in the area, the original data plots are not seen to be very illuminating. The results of the three trials are shown below.

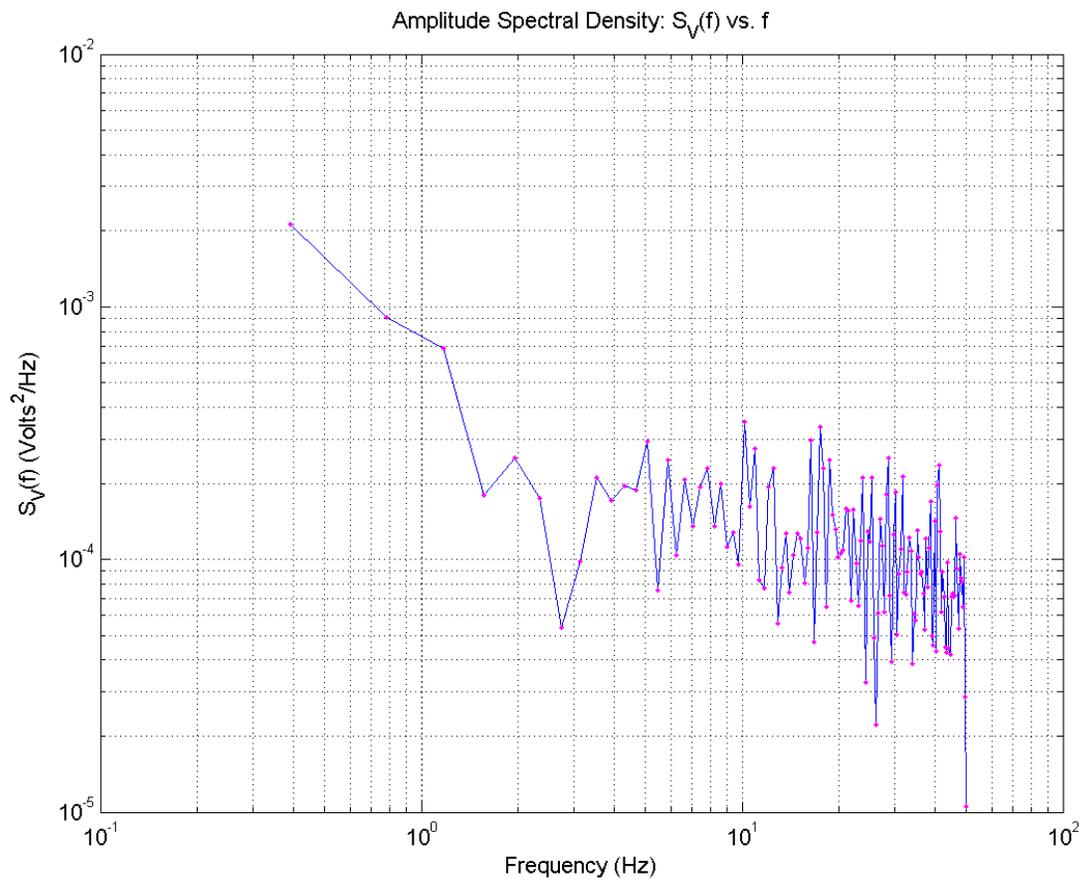
Trial 1:

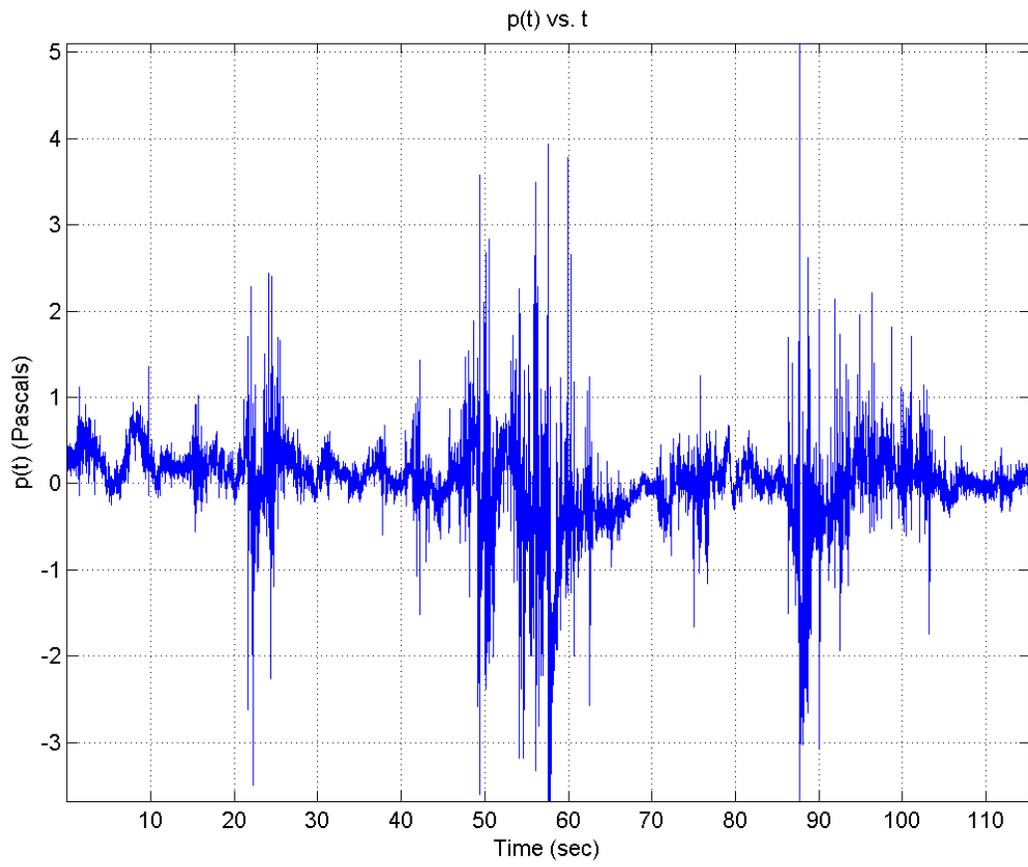




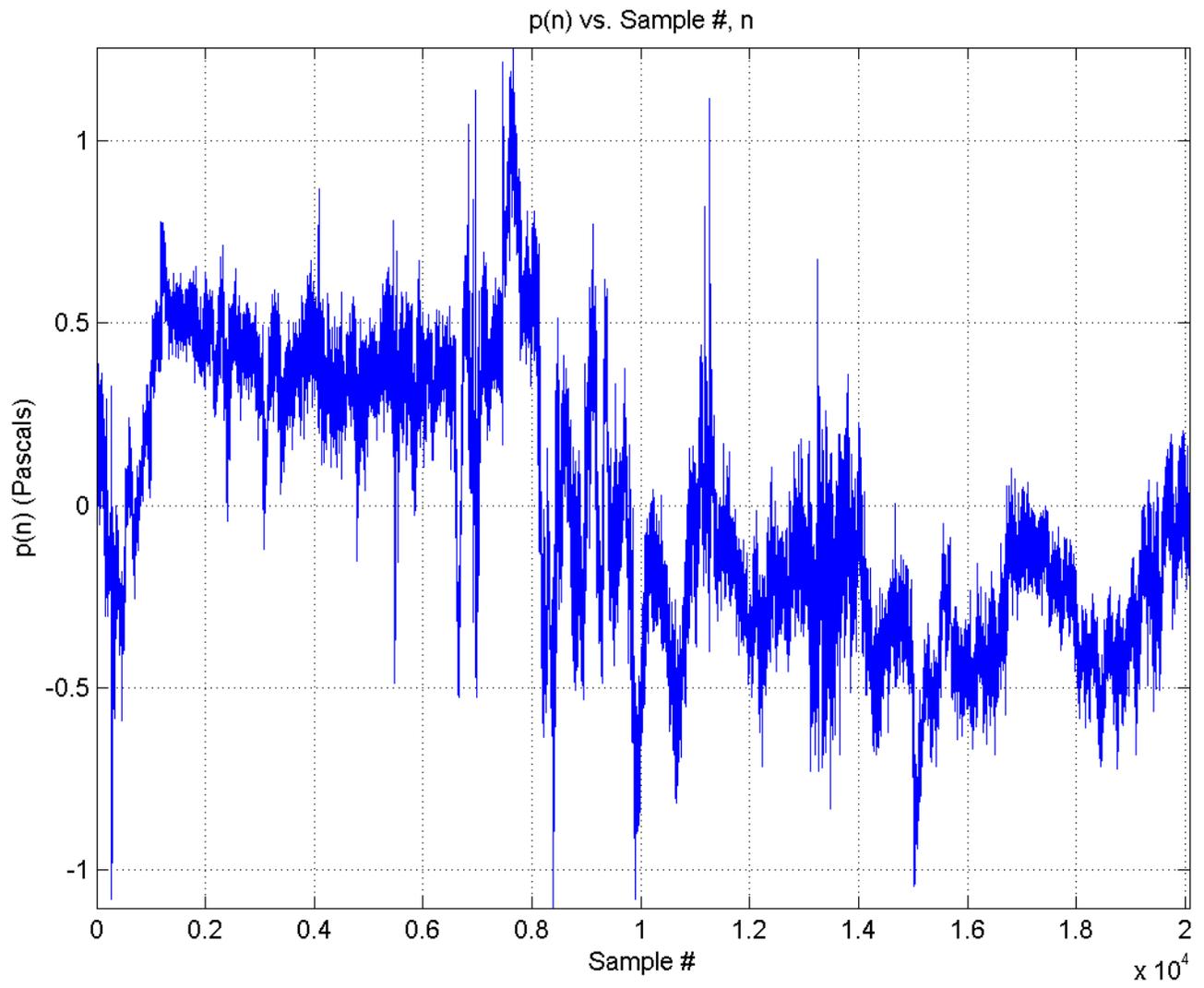


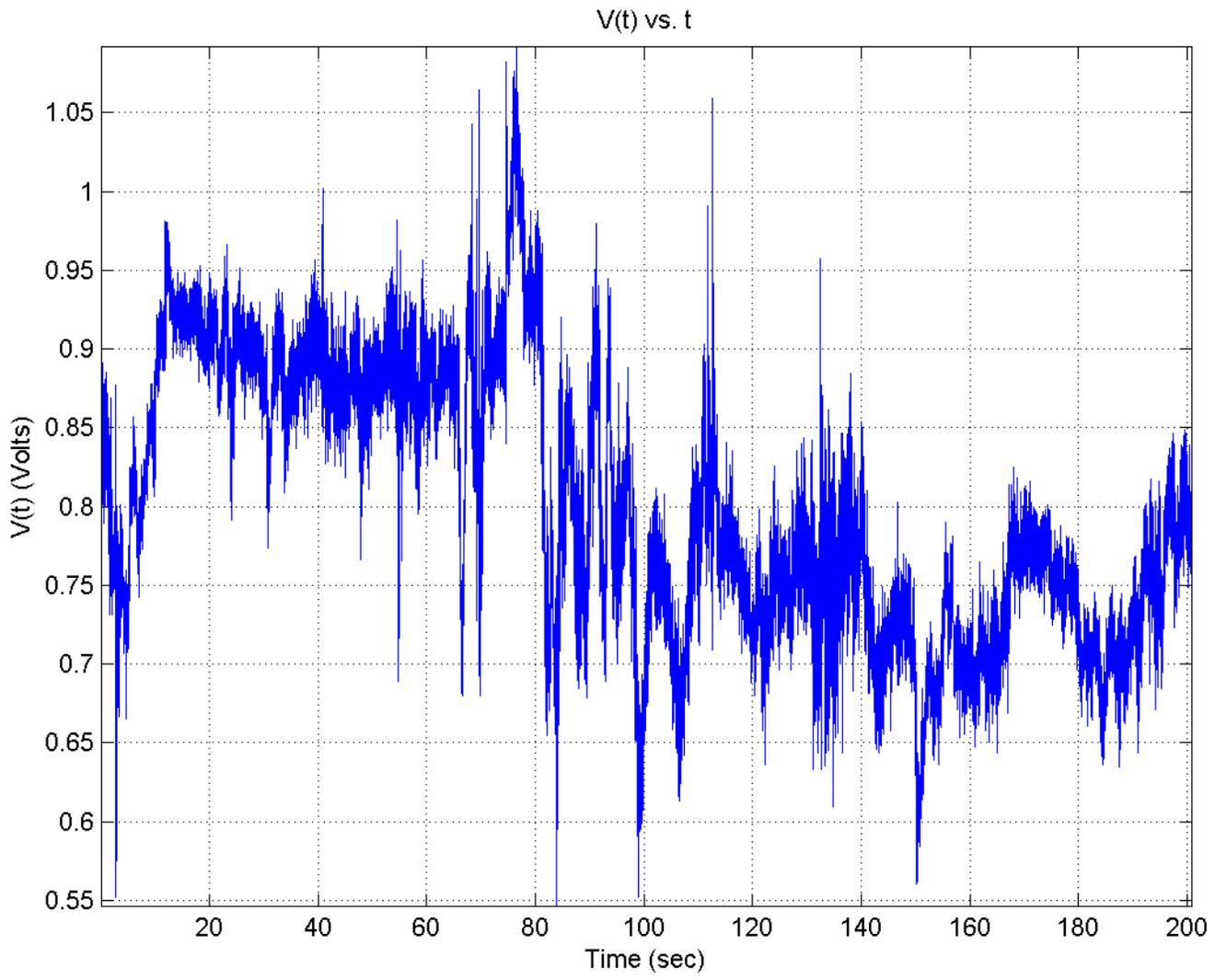




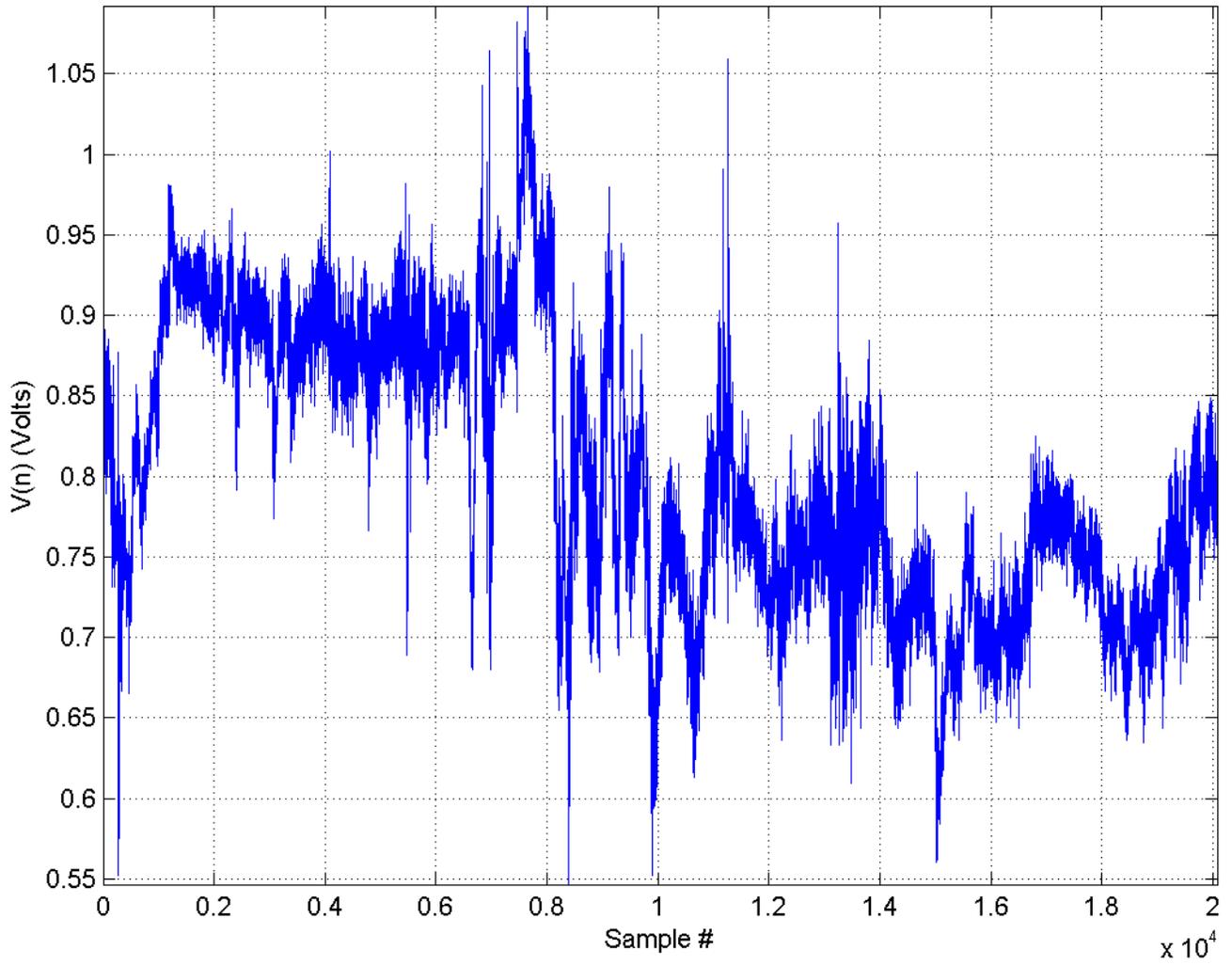


Trial 2:

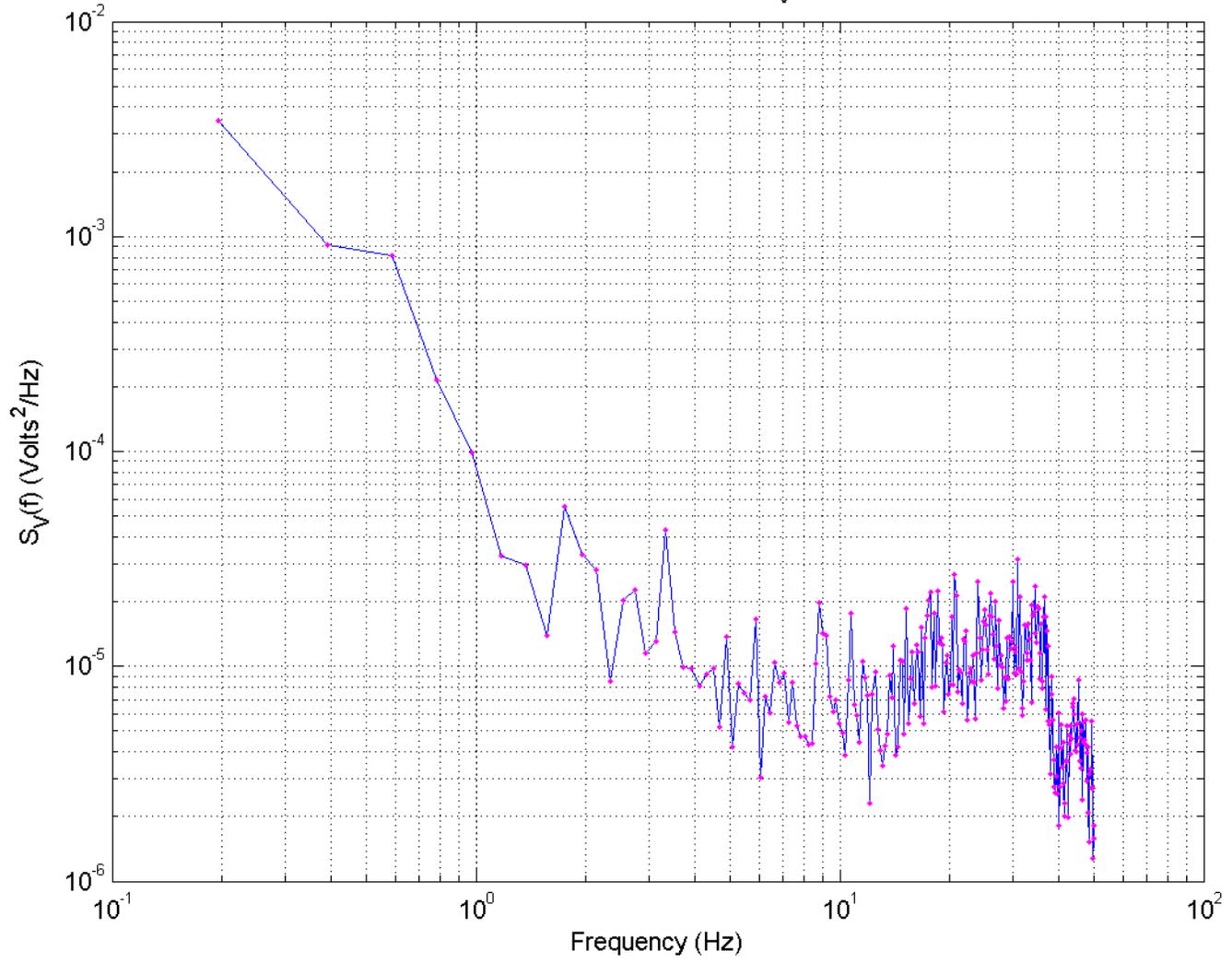


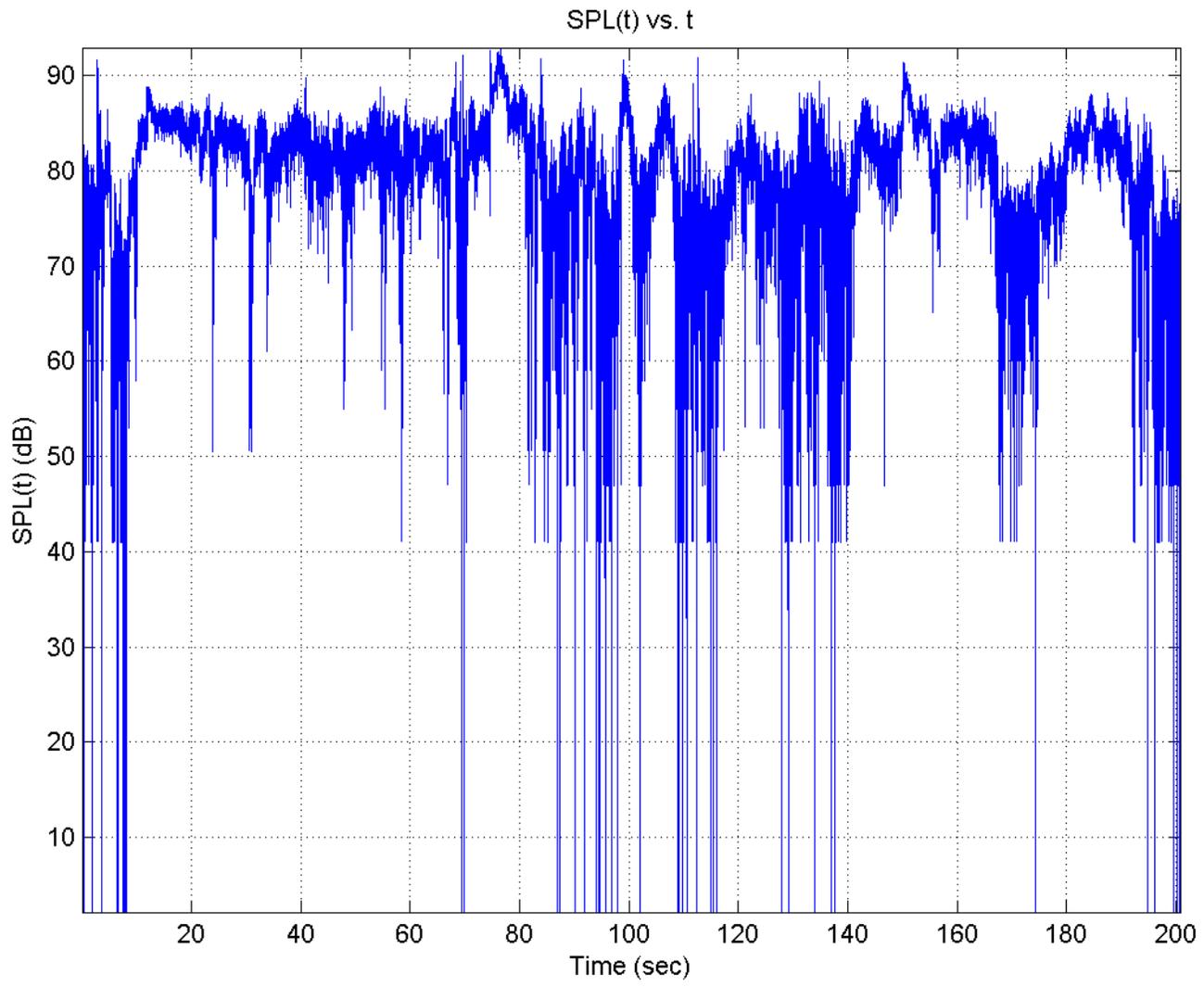


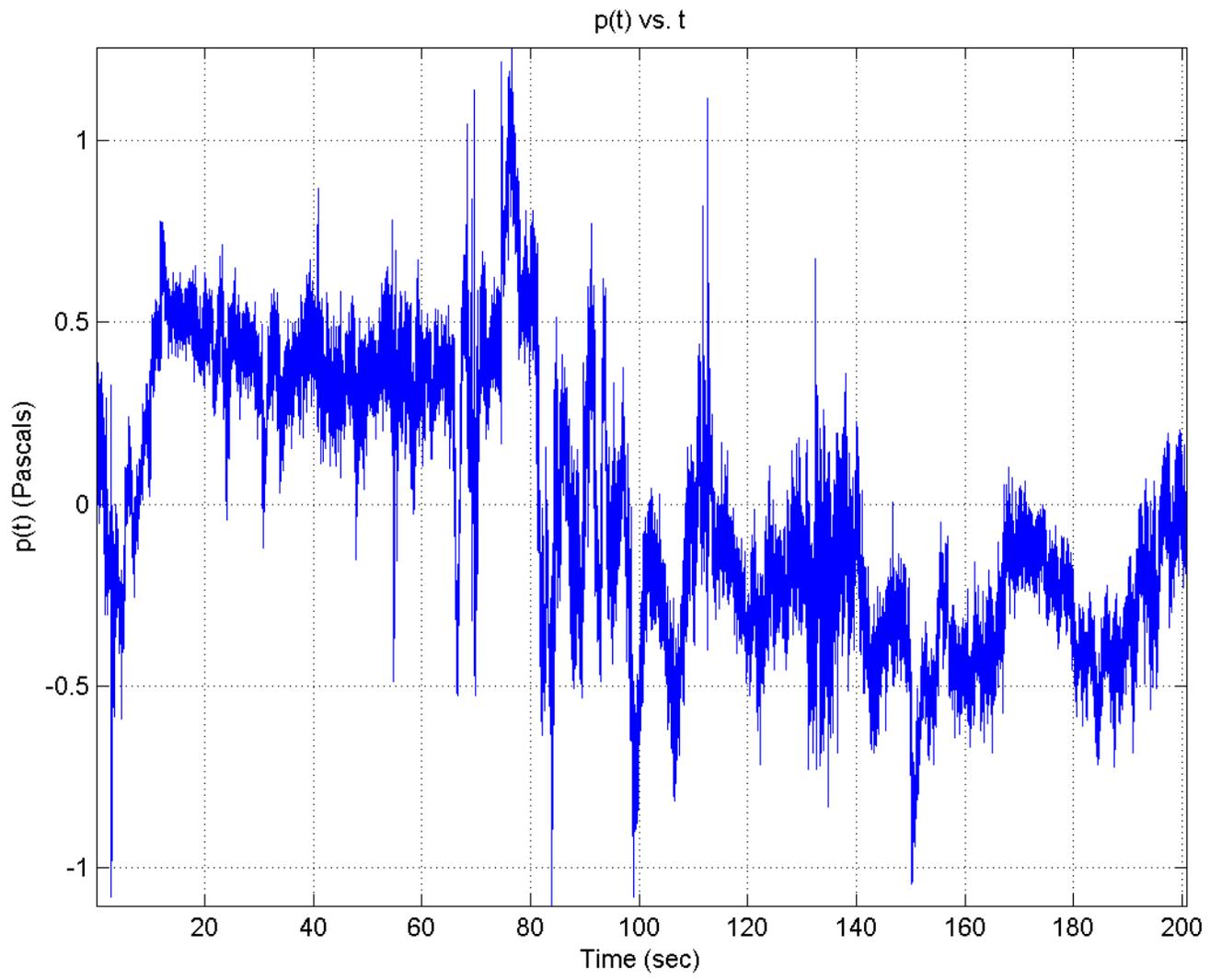
V(n) vs. Sample #, n



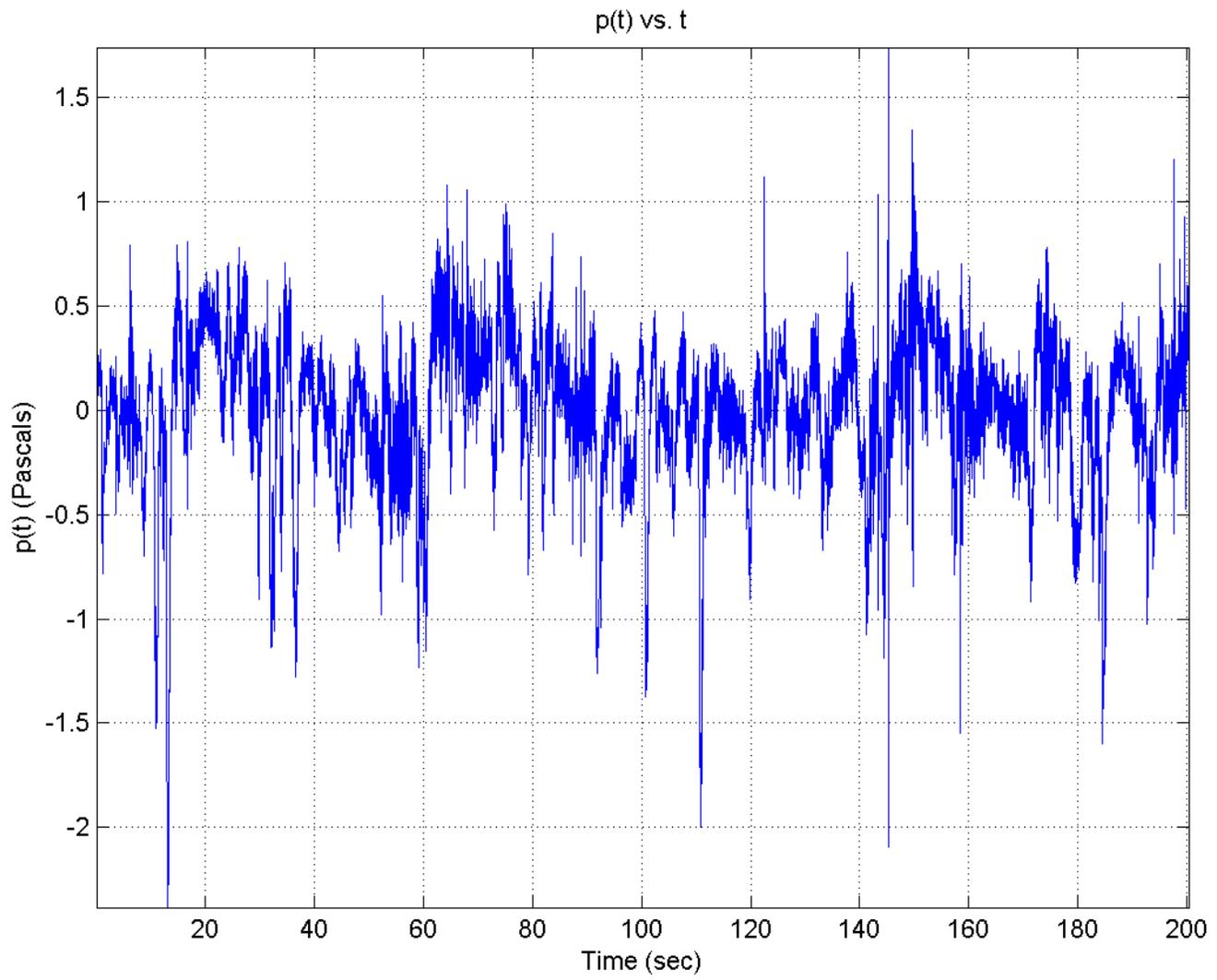
Amplitude Spectral Density: $S_V(f)$ vs. f

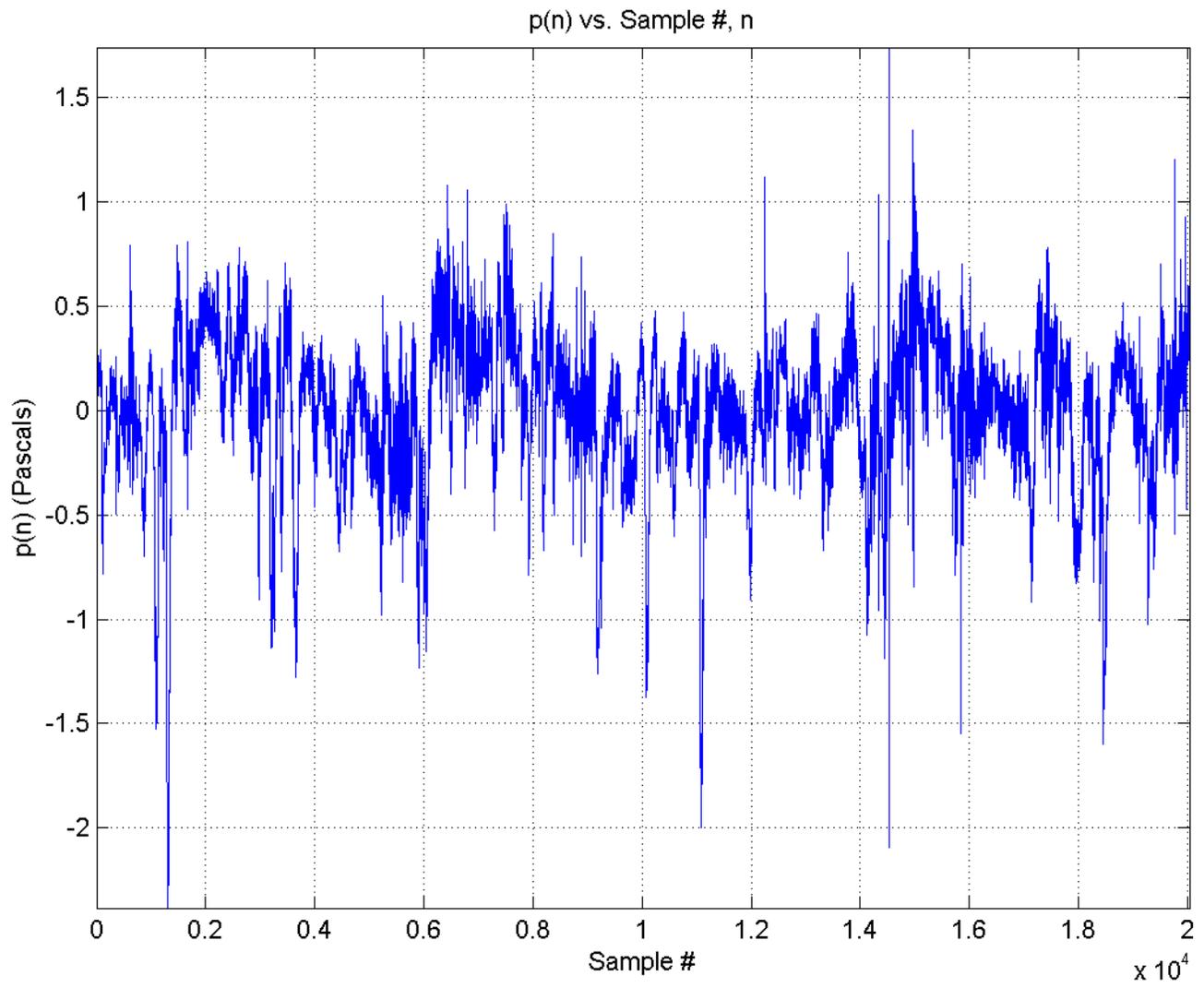


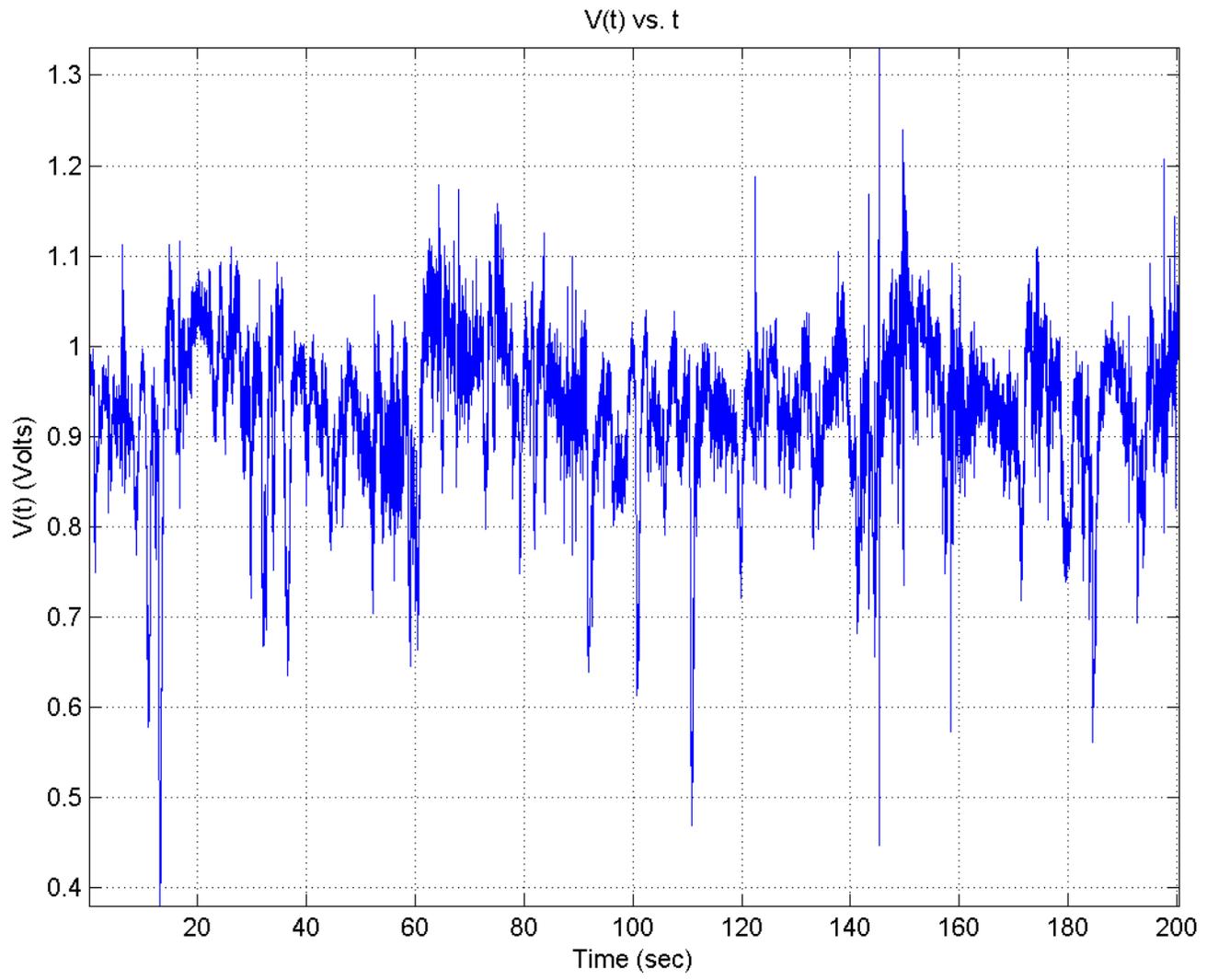




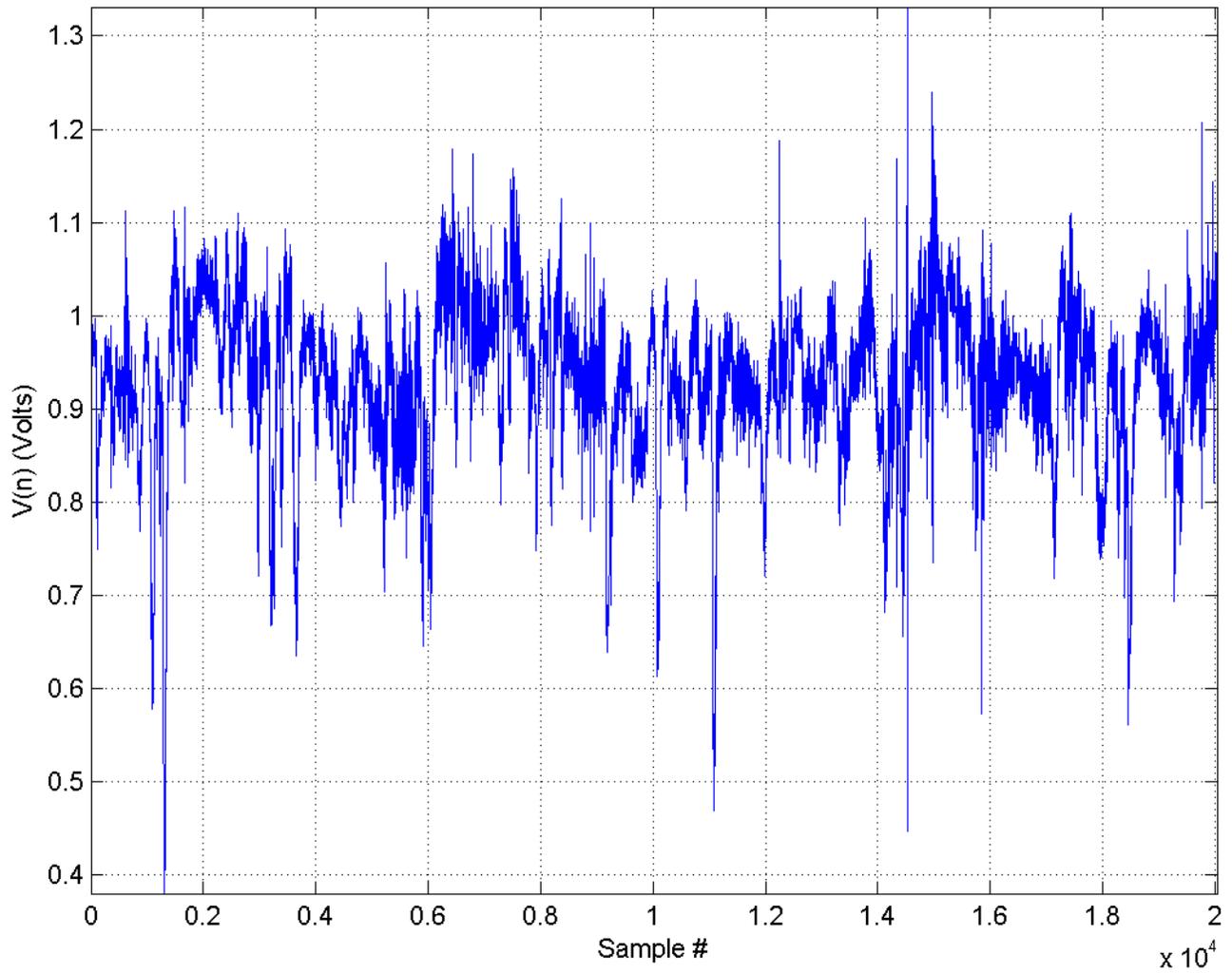
Trial 3:



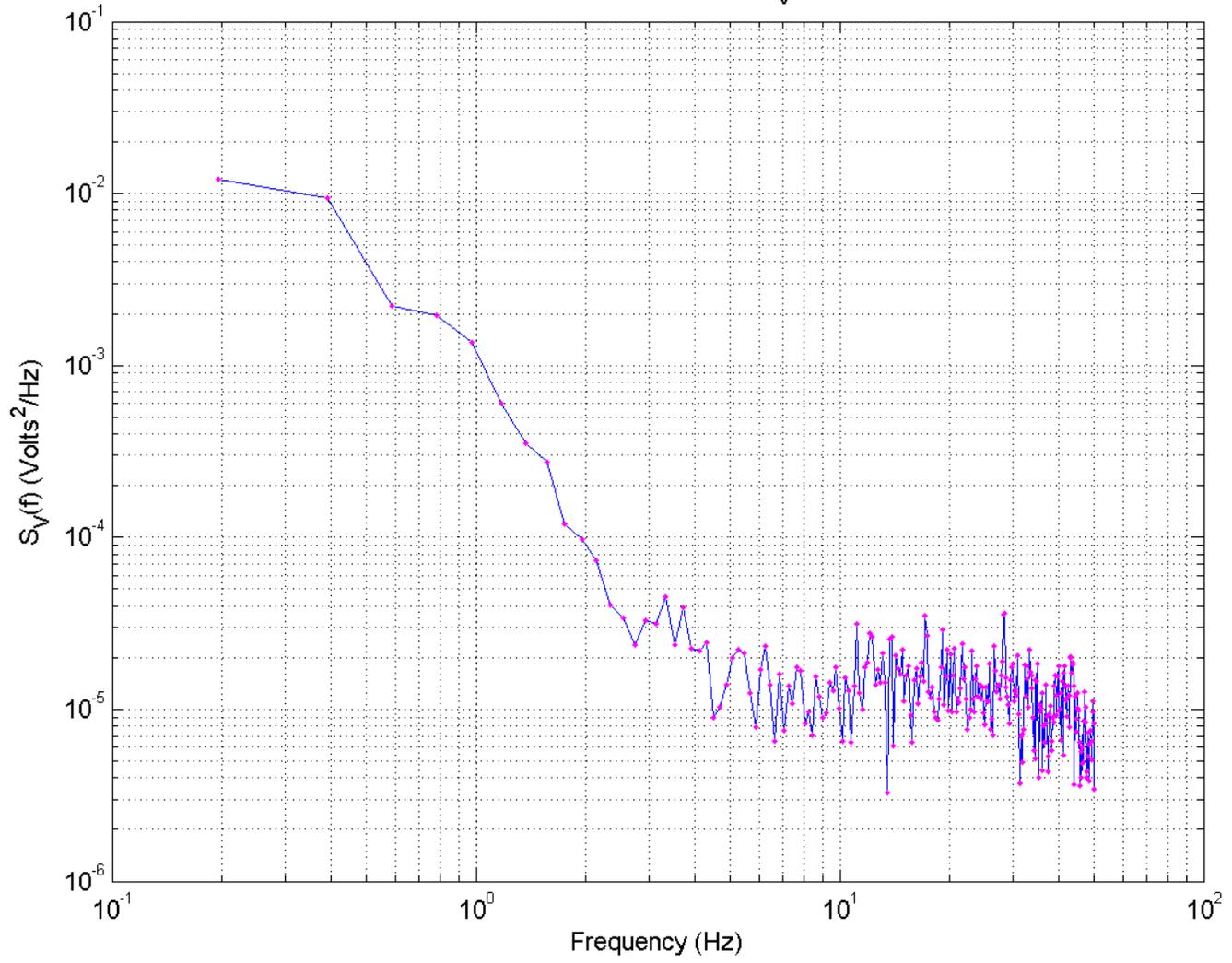




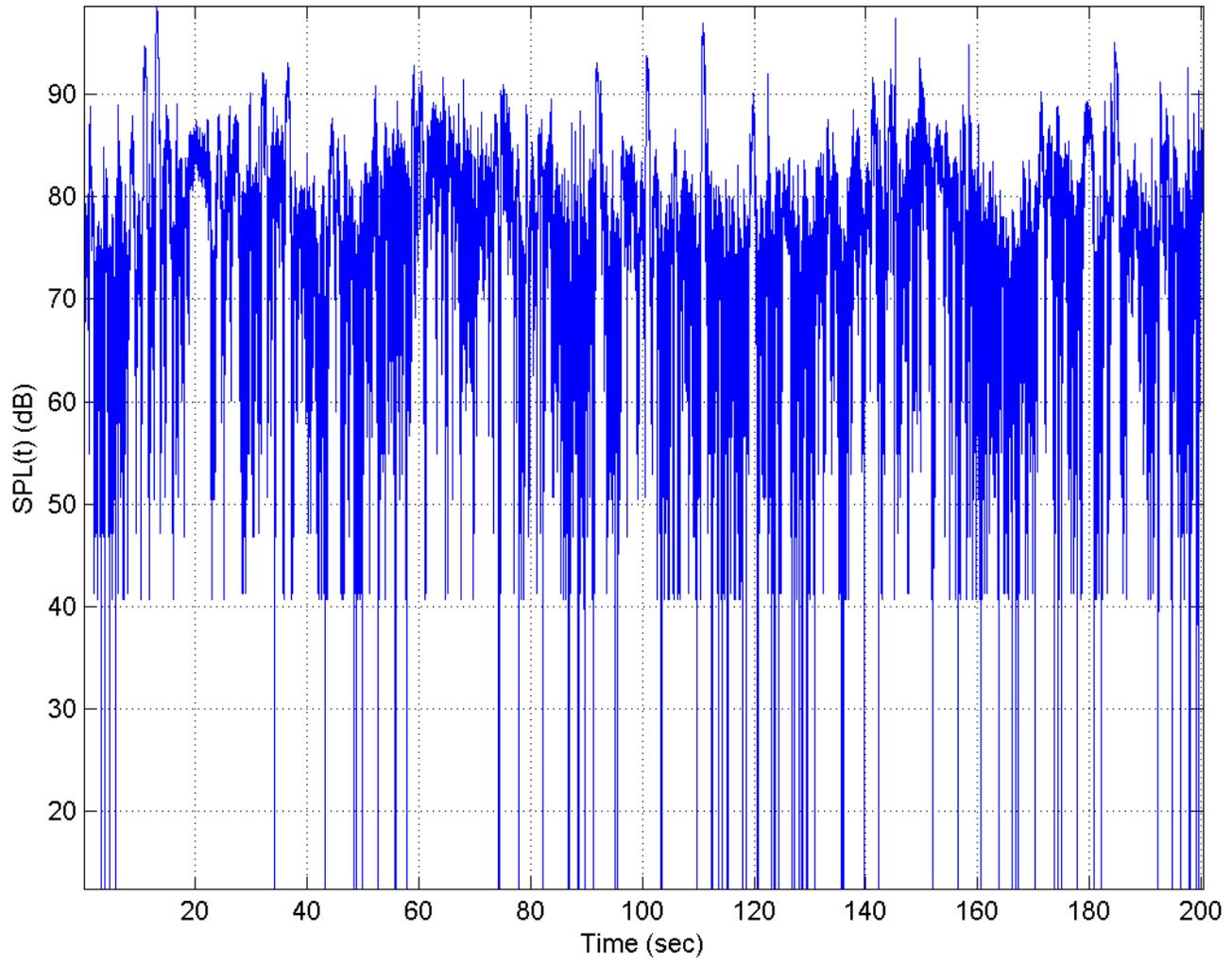
V(n) vs. Sample #, n



Amplitude Spectral Density: $S_V(f)$ vs. f

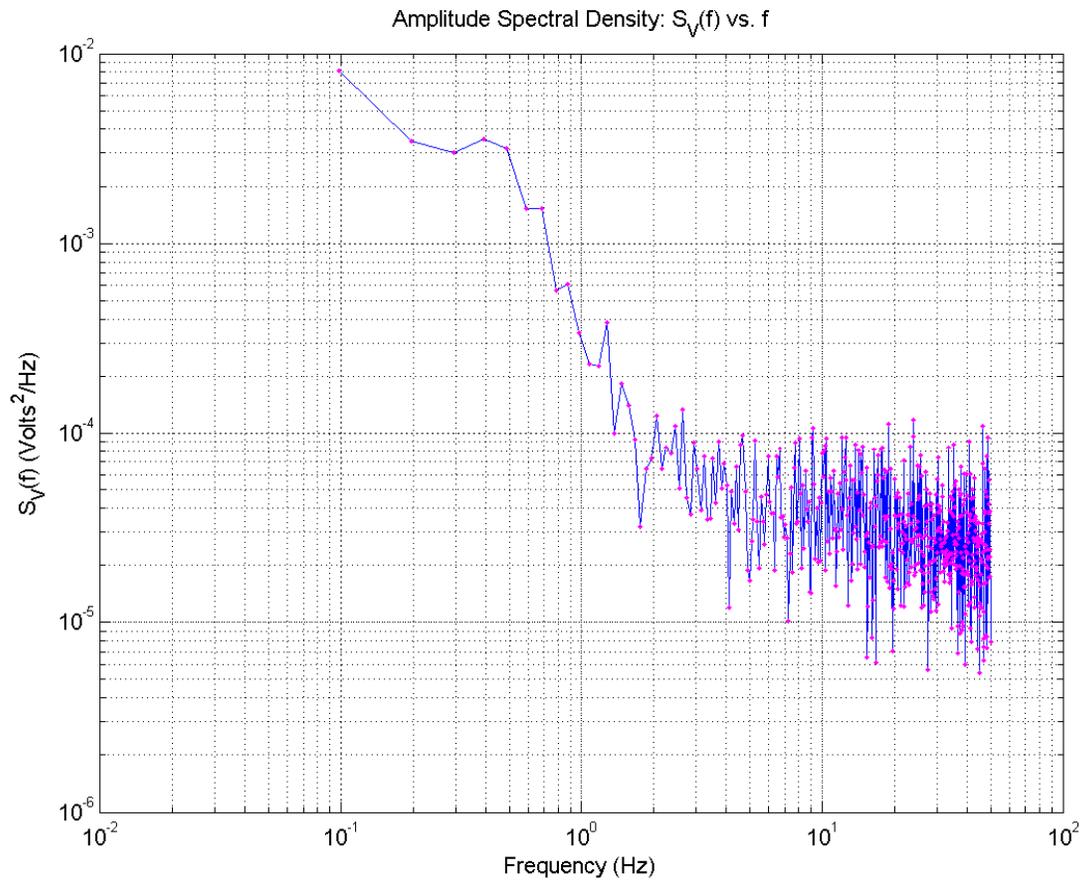


SPL(t) vs. t



Data Analysis

After using a program written by Professor Errede, we were able to eliminate background noise in our samples and combine our data from the three trials into one cohesive data set. Once this was done, it can be seen that there is a peak in the amplitude spectral density around 1 Hertz, which we believe is an indicator of the infrasound produced by the turbine.



Conclusions

Wind turbines, while being a green source of energy which can help eliminate the world's dependence on fossil fuels, produce infrasound. Infrasound from these turbines is thought to produce an effect known as "Wind Turbine Syndrome" in people living near large wind farms, which causes dizziness, nausea, feelings of unease, and sleep deprivation in those affected. We have found what we believe to be evidence of infrasound produced from a single wind turbine using IO Lab software and a program written by Professor Errede to clean up the data. In order to achieve better results in future experiments, data could be taken for longer durations, as low frequency require a longer data period to be seen in the sample. Additionally, the researchers could visit a wind farm instead of a single turbine in order to increase the total sound level from infrasound.