Laboratory Report of Digital Signal Processing

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Score:

Contents

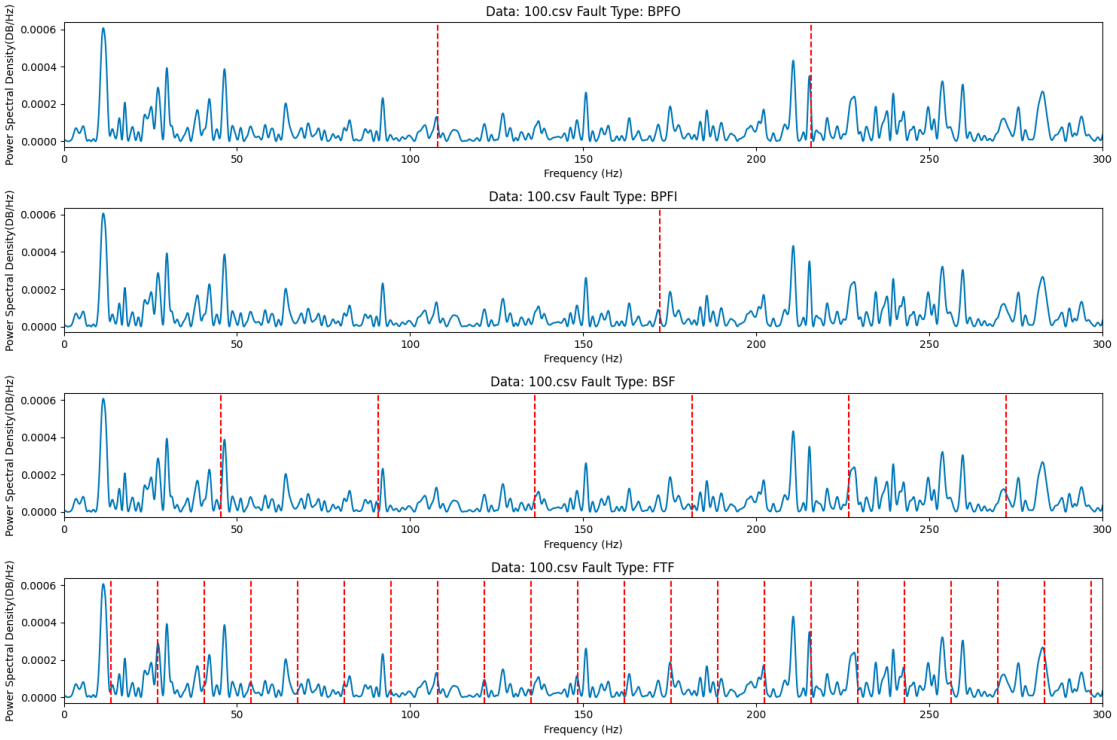
1 Analysis

1.1 `100.csv`

We apply:

1. Envelope Analysis - the function `envelope()` in the code
2. Power Spectrum Analysis - the function `power_spectral_density()` in the code

We get:



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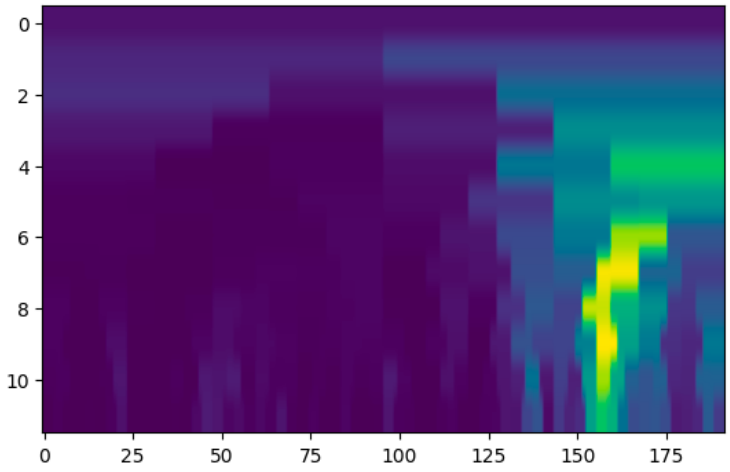
Note that the red vertical lines in the figure represent integer multiples of the corresponding fault frequency.

We can't see any obvious fault frequency in the power density spectrum! The are almost at the same height. However we can apply:

- Kurtosis Analysis - the function `fast_kurtogram()` (author: @danielnewman09 on GitHub) in the code

And we get the Kurtosis Spectrum of this signal:



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And the central frequency and bandwidth that we choose for the bandpass filter:

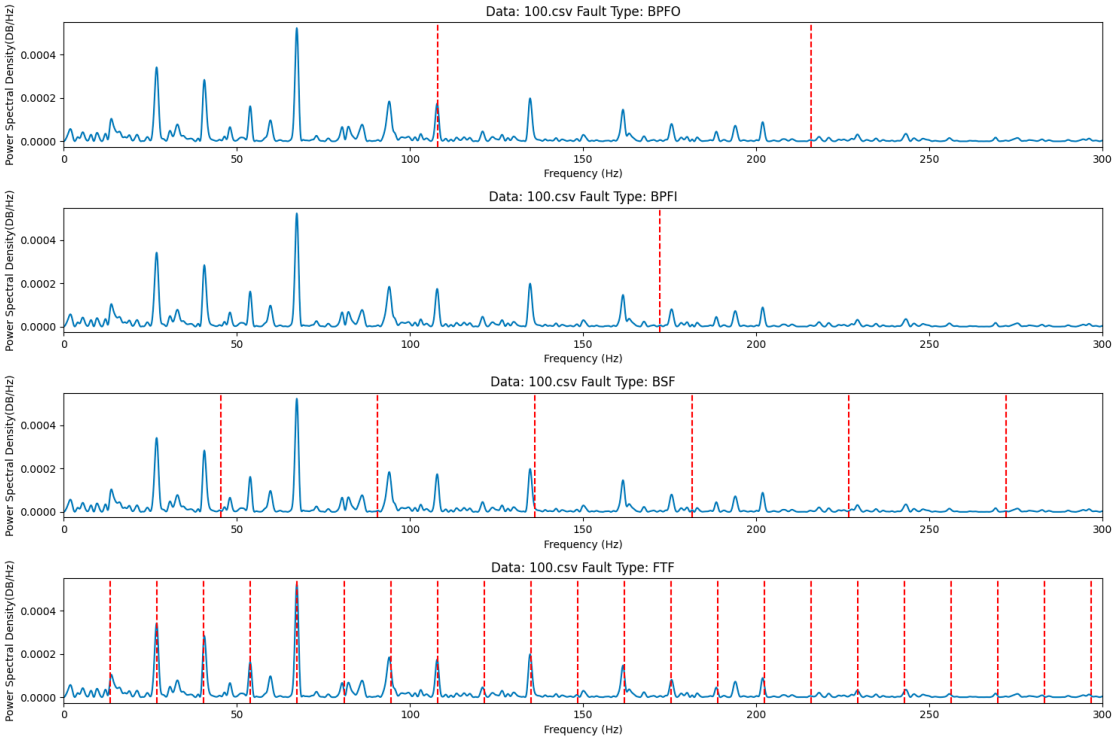
```
Max Level: 5.0
Max Kurtosis: 4.727322791301832
Cental Freq: 10600.0
Bandwidth: 400.0
```

to that signal.

So we apply

1. Bandpass filter with central frequency 10600Hz and bandwidth 400Hz - the function `bandpass_filter()` in the code
2. Envelope Analysis
3. Power Spectrum Analysis

And we get the following spectrum:



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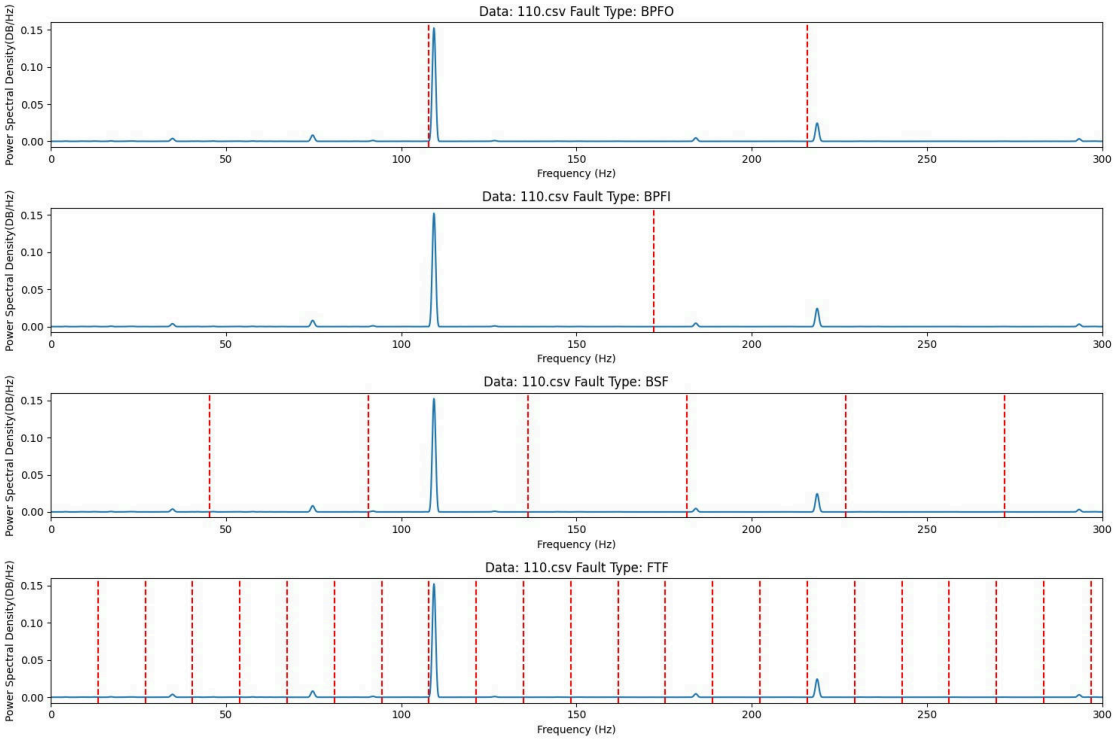
We can now tell the failure mode is **FTF**.

1.2 `110.csv`

We apply:

1. Kurtosis Analysis - `spectral_kurtosis()` in the code
2. Envelope Analysis with a bandpass filter of parameters from Kurtosis Analysis - the function `envelope_analysis()` in the code
3. Power Spectrum Analysis - the function `power_spectral_density()` in the code

and get the image:



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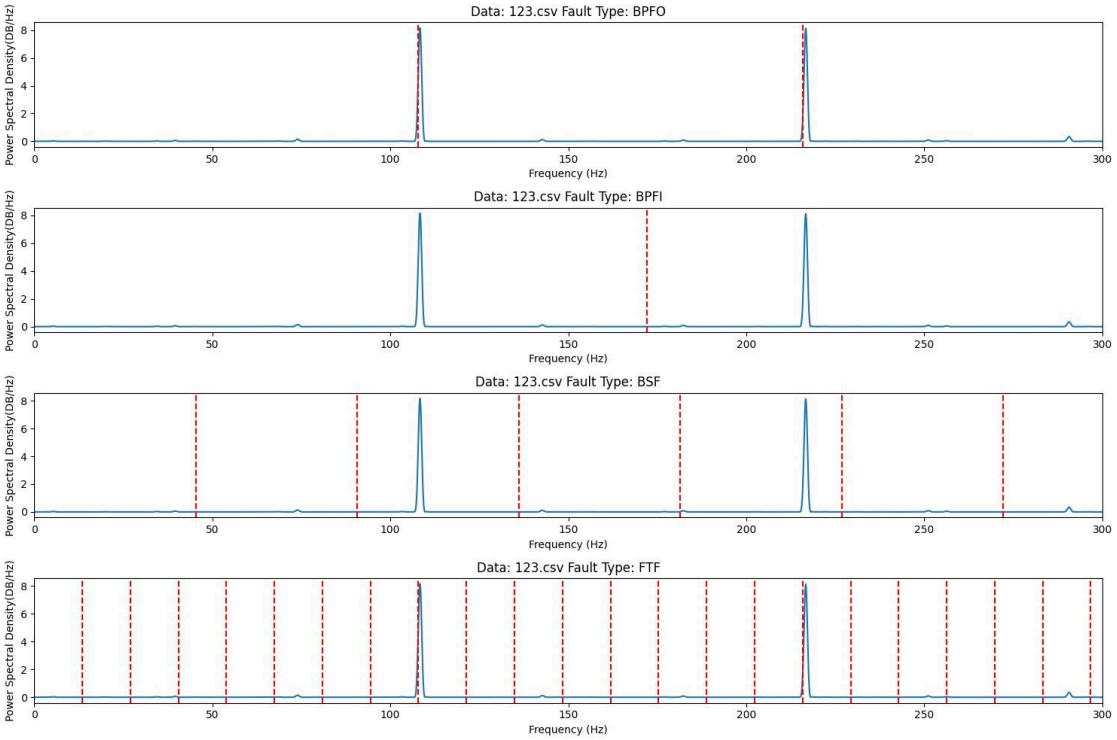
From which we can tell the failure mode is **BPFO**.

1.3 `123.csv`

We apply:

1. Kurtosis Analysis - `spectral_kurtosis()` in the code
2. Envelope Analysis with a bandpass filter of parameters from Kurtosis Analysis - the function `envelope_analysis()` in the code
3. Power Spectrum Analysis - the function `power_spectral_density()` in the code

and get the image:



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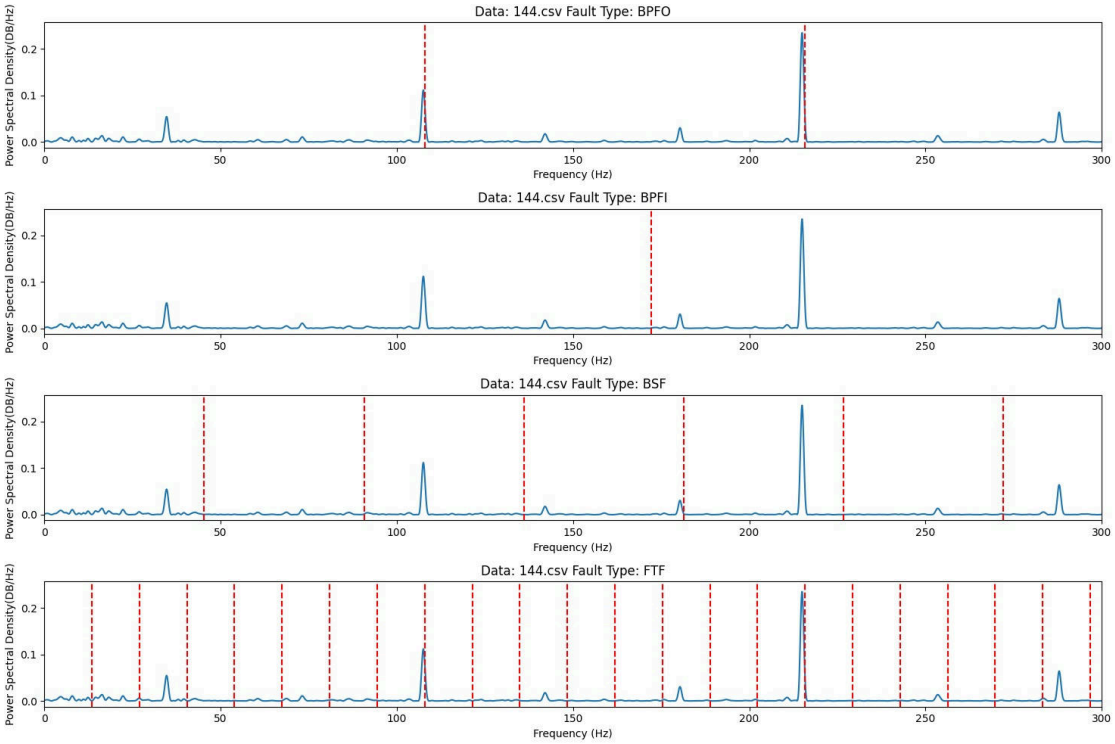
We can tell the failure mode is **BPFO**.

1.4 `144.csv`

We apply:

1. Kurtosis Analysis - `spectral_kurtosis()` in the code
2. Envelope Analysis with a bandpass filter of parameters from Kurtosis Analysis - the function `envelope_analysis()` in the code
3. Power Spectrum Analysis - the function `power_spectral_density()` in the code

and get the image:



No. 521260910012 & No. 521260910018

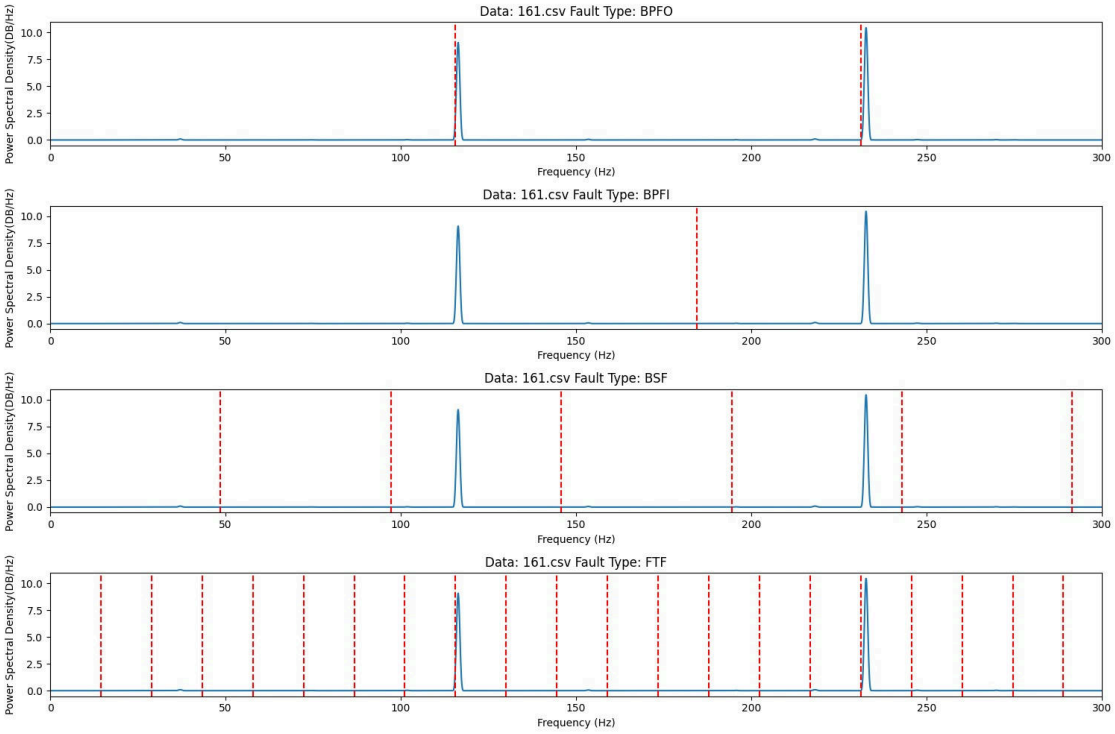
We can tell the failure mode is **BPFO**.

1.5 `161.csv`

We apply:

1. Kurtosis Analysis - `spectral_kurtosis()` in the code
2. Envelope Analysis with a bandpass filter of parameters from Kurtosis Analysis - the function `envelope_analysis()` in the code
3. Power Spectrum Analysis - the function `power_spectral_density()` in the code

and get the image:



No. 521260910012 & No. 521260910018

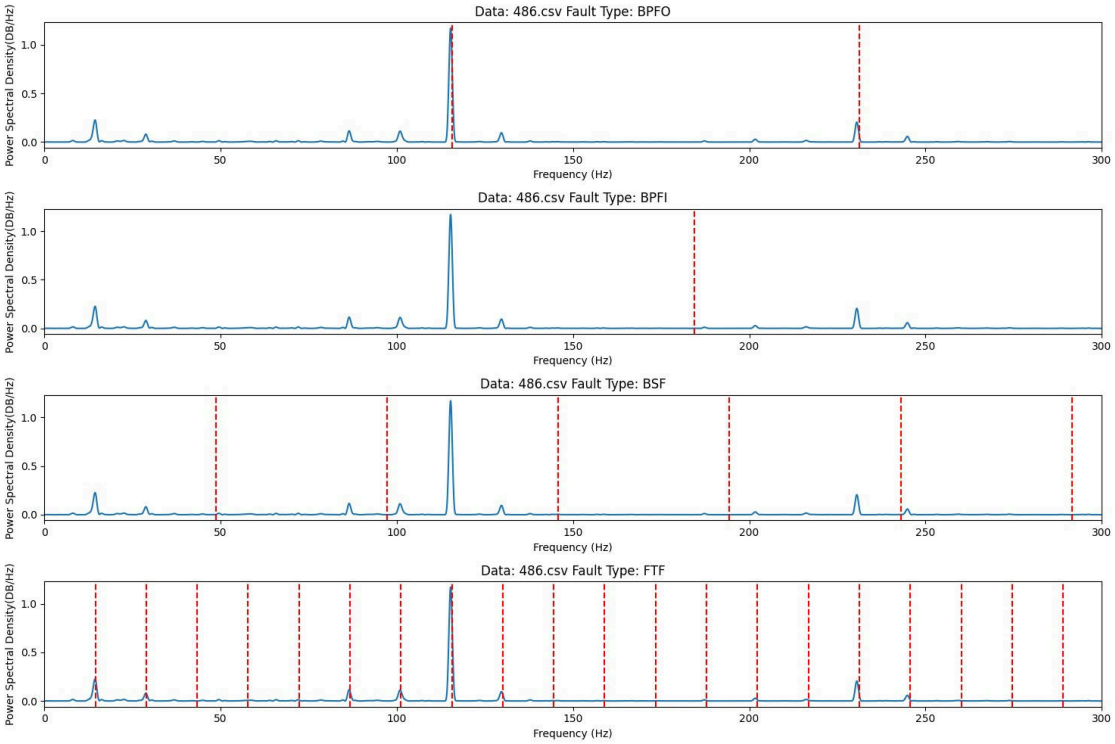
We can tell the failure mode is **BPFO**.

1.6 `486.csv`

We apply:

1. Kurtosis Analysis - `spectral_kurtosis()` in the code
2. Envelope Analysis with a bandpass filter of parameters from Kurtosis Analysis - the function `envelope_analysis()` in the code
3. Power Spectrum Analysis - the function `power_spectral_density()` in the code

and get the image:



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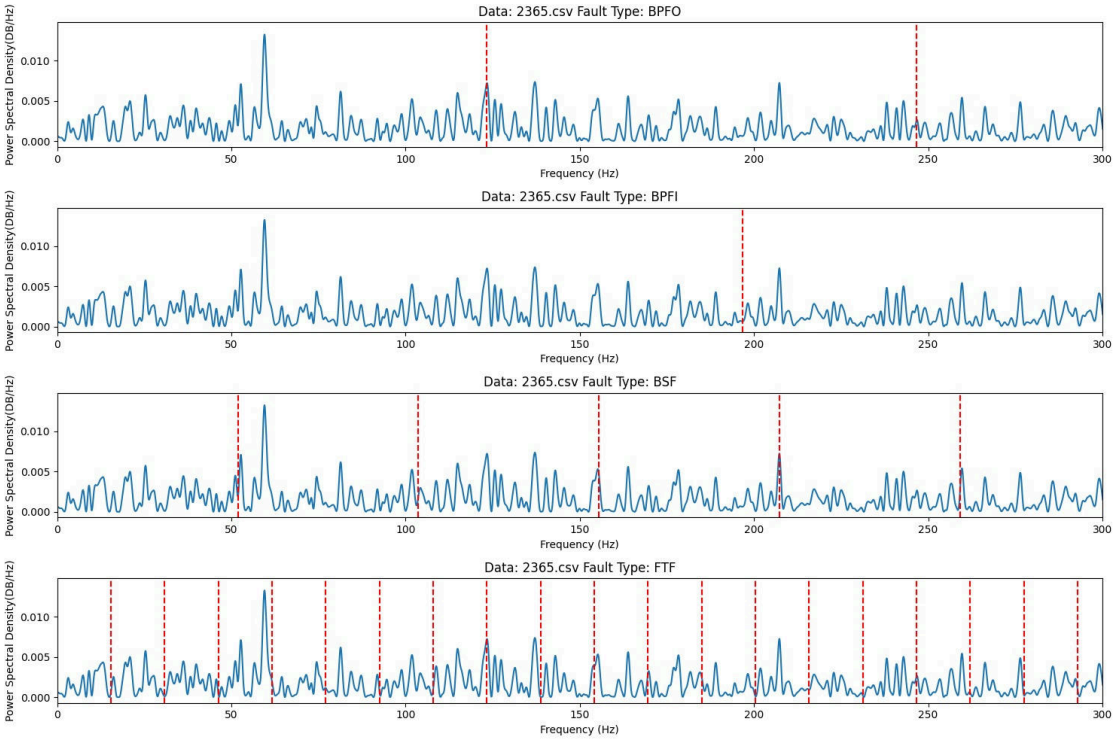
We can tell the failure mode is **BPFO** and **FTF**.

1.7 `2365.csv`

We apply:

1. Envelope Analysis - the function `envelope()` in the code
2. Envelope Analysis with a bandpass filter of parameters from Kurtosis Analysis - the function `envelope_analysis()` in the code
3. Power Spectrum Analysis - the function `power_spectral_density()` in the code

and get the image:



No. 521260910012 & No. 521260910018

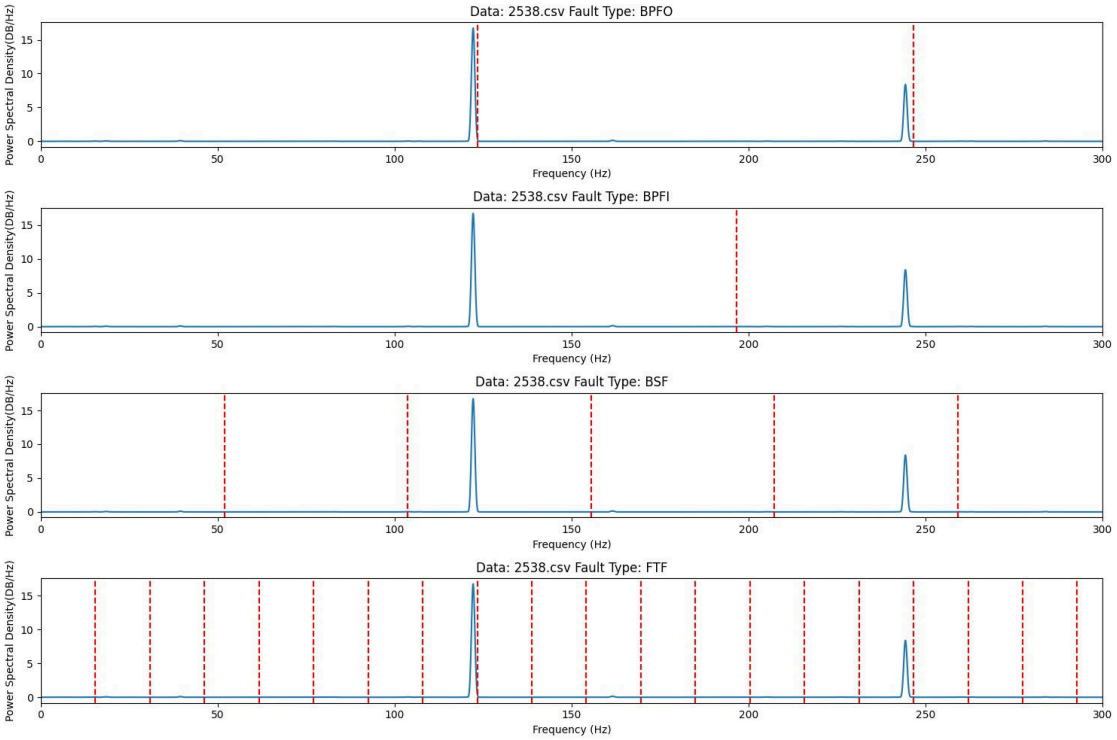
We can tell the failure mode is **BSF**.

1.8 `2538.csv`

We apply:

1. Envelope Analysis - the function `envelope()` in the code
2. Envelope Analysis with a bandpass filter of parameters from Kurtosis Analysis - the function `envelope_analysis()` in the code
3. Power Spectrum Analysis - the function `power_spectral_density()` in the code

and get the image:



No. 521260910012 & No. 521260910018

We can tell the failure mode is **BPFO**.

signal	failure mode
100.csv	FTF
110.csv	BPFO
123.csv	BPFO
144.csv	BPFO
161.csv	BPFO
486.csv	BPFO, FTF
2365.csv	BSF
2538.csv	BPFO

2 Appendix Code

See `main.ipynb`