# The Function of Physics-based Power Spectral Density (PSD) Threshold Filter

Signal denoise based on physics-based PSD threshold filter.

## Description

PSD is used to represent the relationship between the power and the frequency of a signal. With PSD, the distribution of energy can be visualized in the frequency domain. It achieves noise reduction by selecting sidebands. Physics-based PSD threshold filter returns the filtered signal. "File Upload" is used to load the required data set, and the required parameters should be set in the "Parameter" field.

## Parameter introduction

Parameters of physics-based PSD threshold filter:

Sample parameters:

* Sampling frequency: Sampling frequency of the bearing. (data type: float)

Bearing parameters:

* Rotation frequency: Rotation frequency of the bearing. (data type: float)
* Number of rolling elements: Number of balls. (data type: int)
* Ball diameter: Diameter of balls. (data type: float)
* Pitch diameter: Pitch diameter. (data type: float)
* Alpha: Initial contact angle. (data type: float)

Function parameters:

* Frequency band max: Maximum frequency you are interested in. (data type: float)
* Factor: A scalable factor for the user to tune the algorithm. (data type: float)
* Filter mode: A parameter to define what sideband should be considered, here are four modes:
  1. Mode1: No sideband considered, only BPFO, BPFI, BSF, and FTF;
  2. Mode2: No sideband considered, only BPFO, BPFI, BSF, FTF, fr;
  3. Mode3: Only the BPFI's sideband(±fs) considered;
  4. Mode4: Both BPFI's(±fs) and BSF's(±FTF) sidebands considered.
* Cut off frequency: For the low-pass filter to reduce the high-frequency noise. (data type: float)
* Filter method: Without low-pass filter; With low-pass filter.
* Filter order: The defined order of the low-pass filter. (data type: int)

**Functional description of the main components**

The overall view of the function of the physics-based PSD threshold filter is divided into "File Upload", "Parameter", and "Result".

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### File Upload

The uploaded data files support ".mat", ".txt", ".csv", ".xls", and ".npy" format files.



### Parameter

The user can set the parameters here.

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### Result

After the software has been run, click the "Show Result" button to display the signal diagram before and after noise reduction.

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The "Download" button downloads the relevant result images and data.

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**Examples**

The process of using physics-based PSD threshold filter in signal processing to achieve noise reduction.

**Step 1: Configure the procedure**

Select "Data Processing" from the process bar on the left side of the web page.

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**Step 2: Select the function**

Select the procedure that needs to be configured from the process display area.

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The "Physics-based PSD Threshold Filter" function is chosen for signal processing.

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**Step 3: Upload the data file**

Select the data file to be applied from the local path.



Click "Upload" after successfully selecting the upload data file.

**Step 4: Set and save the parameters**

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Firstly, the user needs to set parameters in the blank box.

Then choose the "Filter mode" from the drop-down box.

The option "Filter method" provides the user with the choice of whether to display with the low-pass filter or not.

Finally, click "Save" after all parameters are configured.

**Step 5: Execute the configured procedure**

Before executing the configured function, the user also needs to set the selected output image and file format.

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Finally, select "Run".

**Step 6: Show the result**

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When the progress bar reaches the end, the task is completed.

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Select "Show Result" to simply view the graphical results of the function.

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The displayed result graph is the signal diagram before and after noise reduction.

**Step 7: Download**

Click "Download" to download the file of data and image.

