QFilter User Guide

Vimu Electronic Technology

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contents

1.Introduction

QFilter support design IIR and FIR filter, and design of the filter can be used to collect data filtering and presentation of the theoretical simulation model;

IIR filter which support the "Butterworth", "Chebyshev I "," Chebyshev II ","oval "type of filter design;

FIR filter supports frequency sample method, and Rectangle, bartlett, triangular, cosine, hanning, bartlett_hanning, hamming, blackman, blackman_Harris, tukey, Nuttall, FlatTop, Bohman, Parzen, Lanczos, kaiser, gauss and dolph_chebyshev window function method;

Design results support to save the image; the design of H (z) pole-zero coefficients support save as txt file, for other design system; the design parameters are saved into a fdd format, easy to open and for subsequent waveform processing and simulation.

2.Basic Operation

2.1 X Zoom

When you move the mouse into the drawing area, click where you want to zoom, then scroll the mouse wheel, and the horizontal timeline zooms accordingly.

2.2 X Move

When you move the mouse into the drawing area, press the left mouse button, then move the mouse, and the curve moves accordingly. You can also use the shortcut keys ← and → to move the curve left and right.

2.3 Y Zoom

When the mouse enters the vertical control area on the left, click on the position you want to zoom in, and then scroll the mouse wheel, the horizontal axis of the timeline, and zoom with it.

2.4 Y Move

When the mouse enters the left vertical control area, press the left mouse button, and then move the mouse, and the curve will move accordingly. You can use the shortcut keys "↓" and "↑" to move the left Y curve up and down, and Shift+"↓" and Shift+"↑" to move the right Y curve up and down.

2.5 Cursor measurement

Menu->Cursor, to open the X, Y, and Track 3 types of cursors.

Cur1 and Cur2 can be dragged with the mouse to move the position.

3.Filter Design

3.1 FIR filter design - window method

Click the toolbar "FIR" button in the pop-up menu, select "Window method", will pop up a dialog box, shown in Figure 3.1.

in the dialog box, fill in the desired design of the filter types and their parameters. When choosing and click "design" will appear corresponding to the filter "amplitude(dB)", "amplitude", "phase", "log Amplitude","step response", "zero-pole" and "group delay" seven images.
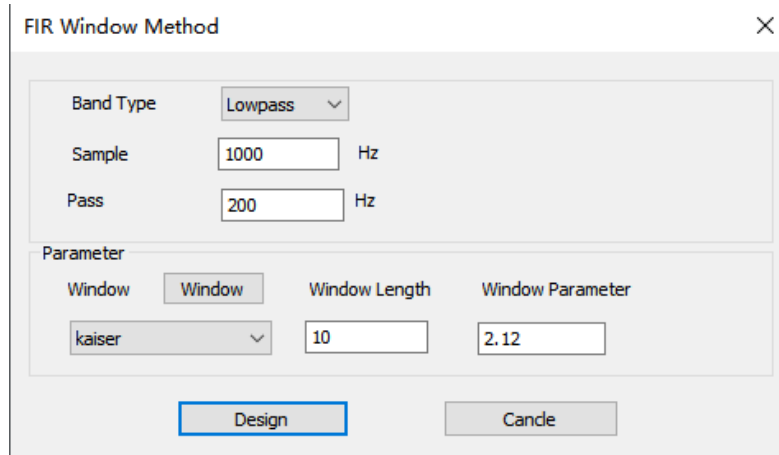
Figure 3.1 FIR Window method design interface

3.2 FIR filter design - frequency sampling method

Click the toolbar "FIR" button, in the pop-up menu select "frequency sampling", will pop up a dialog box, shown in Figure 3.2.

Respectively, according to need to fill the order, the normalized frequency and the corresponding point of the range, plus choosing the type of window, and then click Design. Design was completed and results will appear curve. Design is complete,click OK, there will be corresponding to the filter "amplitude(dB)", "amplitude", "phase", "log Amplitude","step response", "zero-pole" and "group delay" seven images.
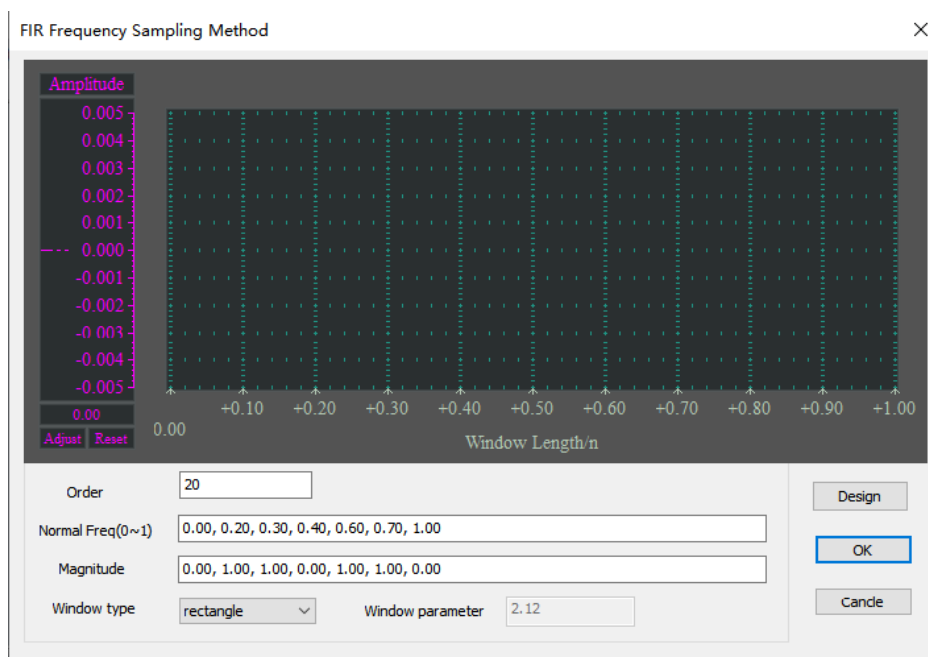

Figure 3.2 frequency sample design interface

3.3 IIR filter design

Click on the toolbar "IIR" button will pop up a dialog box in the dialog box, shown in Figure 3.3.

fill in the desired design of the filter types and their parameters. And FIR as fill parameters

each time, and move the mouse, the software will be completed to determine the parameters are correct, if there is an error, the bottom of the dialog box will display, where the parameter is incorrect; when all parameters are right after the "order of the budget" will be given in the design of indicators to meet the kind of order of the filter.

Of course, you can also to choose the filter type, can be "Butterworth", "Chebyshev I", "Chebyshev II" and "ellipse" and its order number. When choosing and click "design"will appear corresponding to the filter "amplitude(dB)", "amplitude", "phase", "log Amplitude","step response", "zero-pole" and "group delay" seven images.
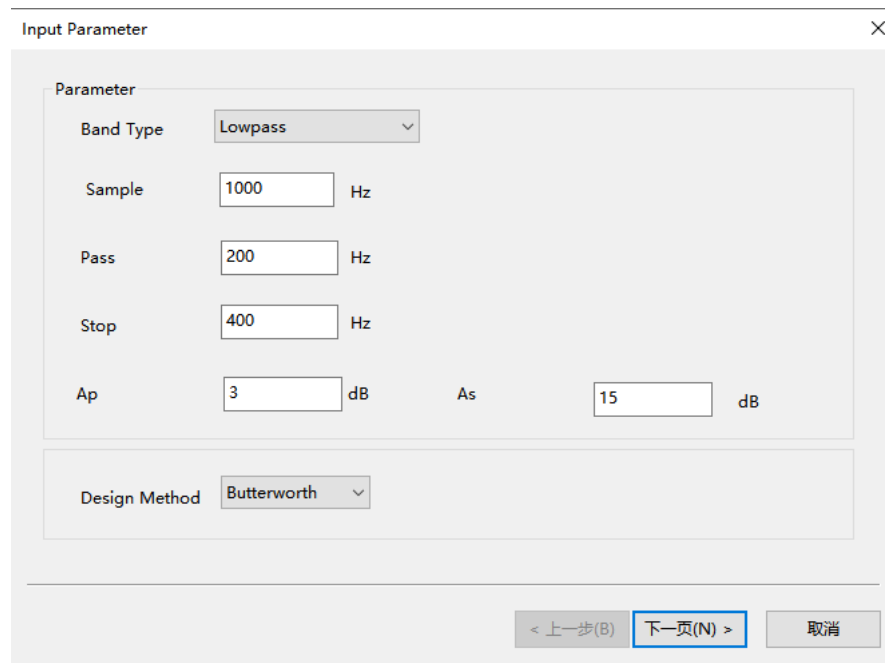

Figure 3.3   IIR design interface

3.4 Data and bmp save

When designing a good filter, you can save the data and images. Click on the toolbar or menu item "Save" dialog box will pop up to save, in the "Save as type" drop-down combo box, select the corresponding txt, fdd would be able to filter H (z) coefficients stored, select the bmp they can save the images (Figure 3.4).

For txt format, in the dialog box below, "the output coefficient formatting", you can specify to save H (z) or pole-zero; can specify the output of H (z) pole-zero coefficients and in what kind of format, you can also choose whether the parameters and then multiplied by a factor of the output. For example: Select% 0.0f, and multiplied by the factor given is 4096, then the output will be multiplied by the coefficient will be designed after the integer part of 4096, there is no fractional part.

For fdd format, the filter can be designed for each parameter are preserved for future to open or for a given waveform filtering.

For the bmp format, you can "bmp save" and select "Save all images" check box, so one will be able to save seven images.
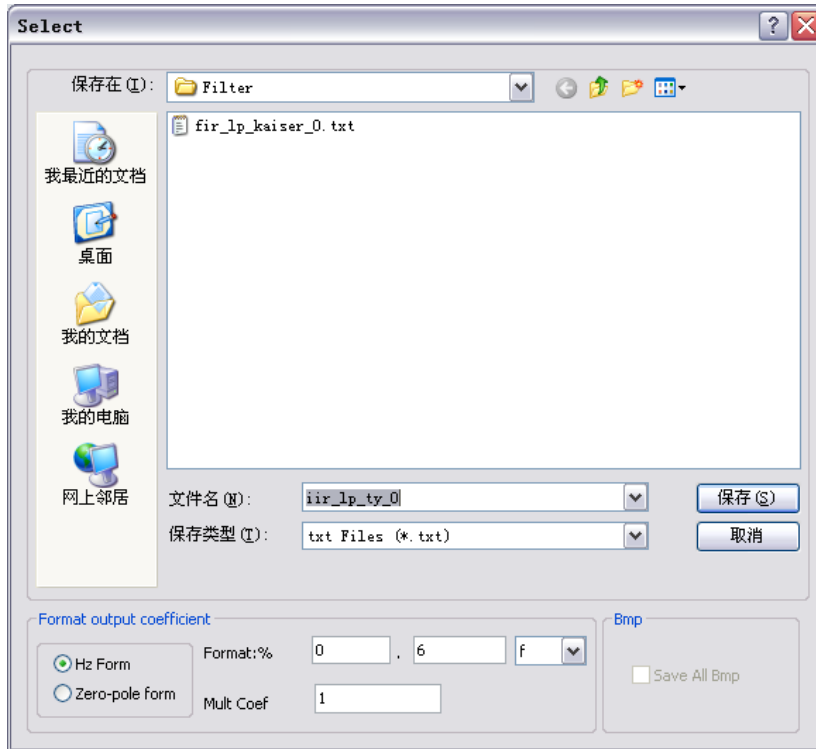
Figure 3.4   save dialog

4.Filter Test

Run "Mixed signal oscilloscope",The interface is shown in the figure 4.1.
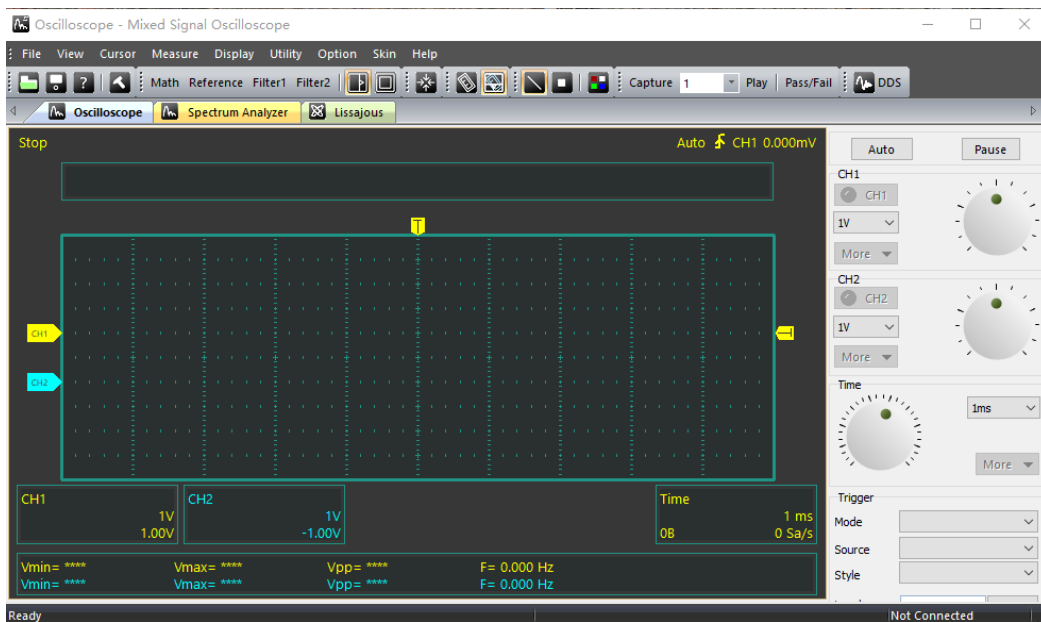
4.1 Filter Test

Figure 4.1   Mixed signal oscilloscope interface

4.1.1 Test data selection

1,Connect the hardware device, open the channel CH1, CH2, and directly use the data collected by the hardware as the filter test data;

2,Open the saved file, which can be osc or csv format.

4.1.2 Filter test switch

Toolbar, click the Filter1 or Filter2 button, as shown in Figure 4.2. Launch the filter settings screen as shown in Figure 4.3.

Figure 4.2 Filter switch

4.1.3 Filter settings interface

"Source" Set the sources for filter, which can be CH1, CH2, Math, and Ref;

"Filter fdd File" Select the fdd file, which is designed by the QFilter;

"FLT1" /"FLT2" Turn filtering on and off and the corresponding curves;

"Voltage/Grid"Adjusts the vertical scale of the FLT1/FLT2 curve;

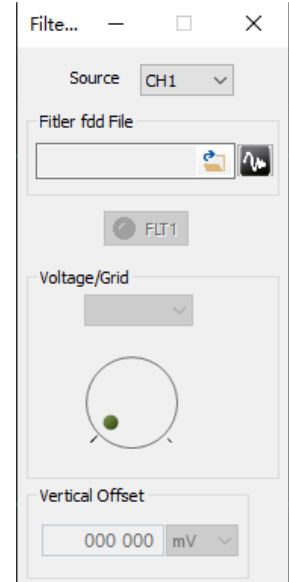"Vertical Offset"Adjusts the vertical offset of the FLT1/FLT2 curve.

4.2 Filter design and usage routines

4.2.1 Observe the processed signal

Select the Spectrum Analyzer, click FFT1, open the FFT1 test; select the window function rectangle, and the reference value select the dBVrms;

Figure 4.3 Filter test interface

Select the Oscilloscope, File-> Open, select QfilterData1.osc File;

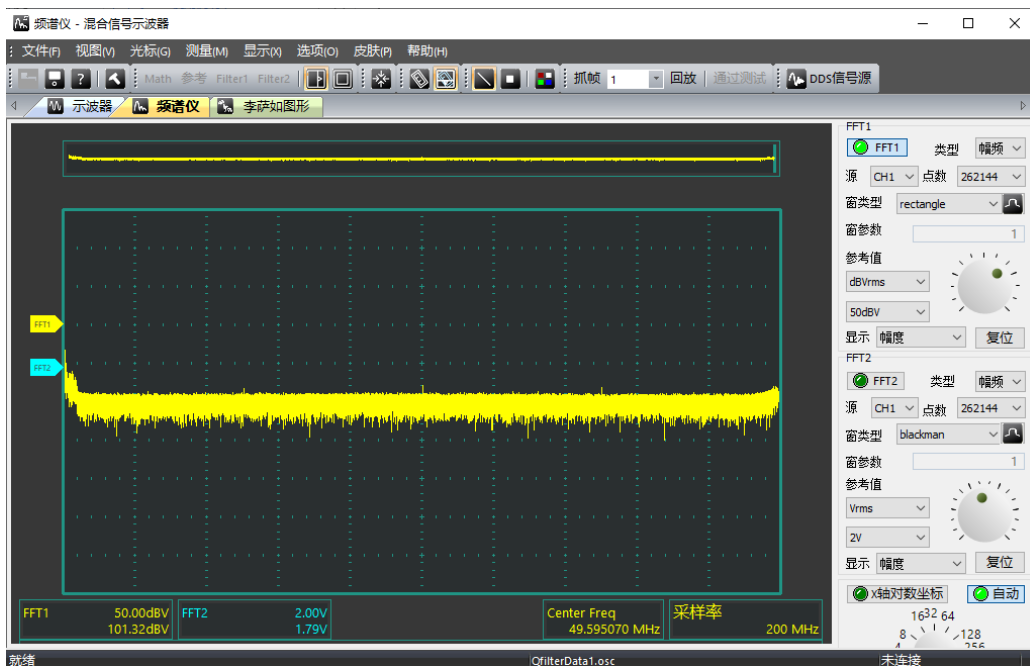By looking at the FFT spectrum, we can roughly determine that the effective data is within 2MHz. Figure 4.4

Figure 4.4 QfilterData1.osc Data FFT Result

4.2.2 Design filters

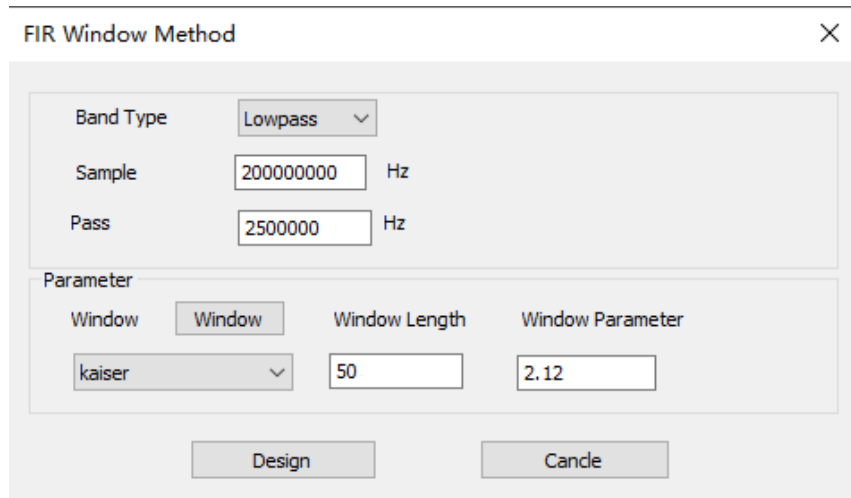Design a FIR filter as shown in Figure 4.5 and save it as fir_lp_kaiser_0.fdd。

Figure 4.5 FIR Design parameters

4.2.3 Filter verification

Select the Oscilloscope,open Filter1 interface,Source Select "CH1",fdd file select "fir_lp_kaiser_0.fdd",Open FLT1 switch.

Select the Spectrum Analyzer, Open FFT2, Source Select "FLT1",and the reference value select the dBVrms.

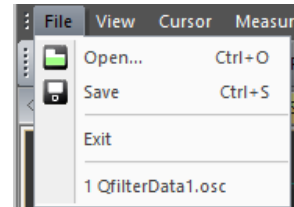Select the Oscilloscope,File->Select QfilterData1.osc，open the data again. Figure 4.6

Figure 4.6
Open the history file

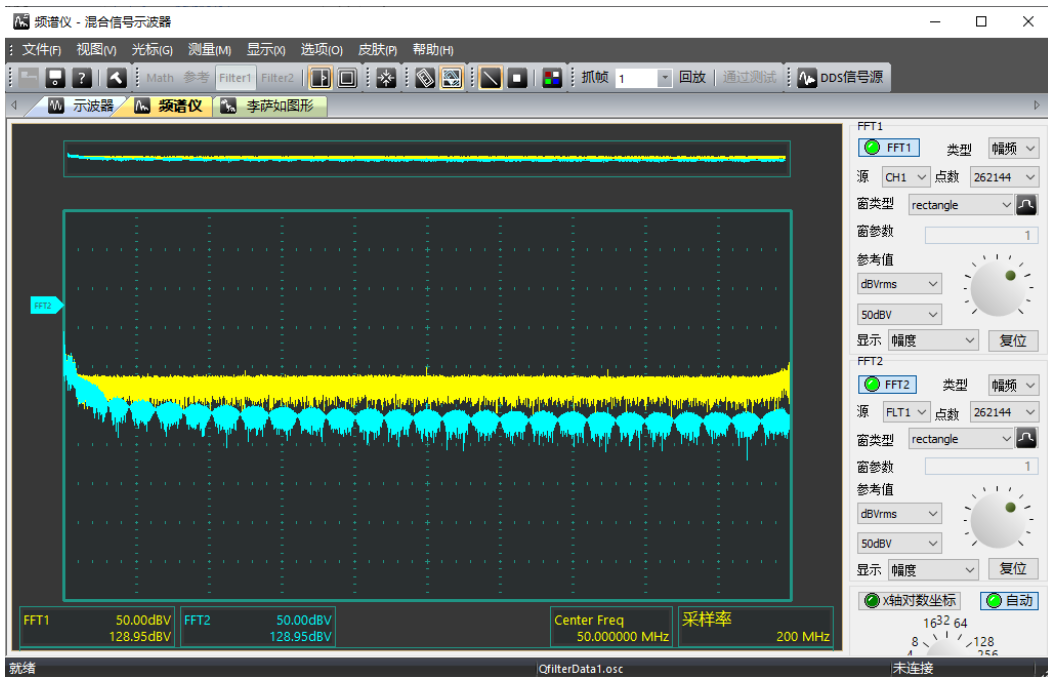Figure 4.7 shows the FFT comparison diagram before and after filtering.

Figure 4.7 Spectral comparison before and after

4.2.4 Filter coefficients save

The completed filter needs to be exported from the filter coefficients and used in other systems.

QFilter software, file - > save, select txt format, save as "fir_lp_kaiser_0.txt".

4.2.5 Filter coefficients used

For window and Linux systems, our "Digital Signal Processing Library" can be used to filter the corresponding waveform. For specific operation and use, please refer to "Digital Signal Processing Library User Manual V1.1.Pdf"

For embedded systems, the h coefficient in the "fir_lp_kaiser_0.txt" needs to be added to the corresponding library according to the corresponding chip manual.

Digital signal processing library github link：https://github.com/vimu-tech/vmsignal