Cascading Biquads To Create Even-Order High/Low Pass Filters

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To set up an IIR filter, especially high pass filter and low pass filter, it is known to define the order and type of the filter such as Butterworth, Linkwitz-Riley or Bessel.

A digital biquad filter is a second order IIR filter. To achieve a certain type and/or other even-order filter, the practitioner could use multiple biquad filters with specific Q values.

The table below is a quick reference guide for creating 2nd, 4th and 6th order Bessel, Butterworth and Linkwitz-Riley HP/LP filters by implementing biquad filters. The frequency of all biquad filters should remain the same.

Order	Type	Biquad filter #1	Biquad filter #2	Biquad filter #3	Biquad filter #4
2nd	Bessel	Q = 0.58	N/A	N/A	N/A
	Butterworth	Q = 0.71	N/A	N/A	N/A
	Linkwitz-Riley	Q = 0.5	N/A	N/A	N/A
4th	Bessel	Q = 0.52	Q = 0.81	N/A	N/A
	Butterworth	Q = 0.54	Q = 1.31	N/A	N/A
	Linkwitz-Riley	Q = 0.707	Q = 0.707	N/A	N/A
6th	Bessel	Q = 0.51	Q = 0.61	Q = 1.02	N/A
	Butterworth	Q = 0.52	Q = 0.71	Q = 1.93	N/A
8th	Bessel	Q = 0.51	Q = 0.56	Q = 0.71	Q = 1.23
	Butterworth	Q = 0.51	Q = 0.6	Q = 0.9	Q = 2.56
	Linkwitz-Riley	Q = 0.54	Q = 0.54	Q = 1.31	Q = 1.31

For example, in Filter Hose we can create a 4th order Butterworth LP filter by inputting the following values:

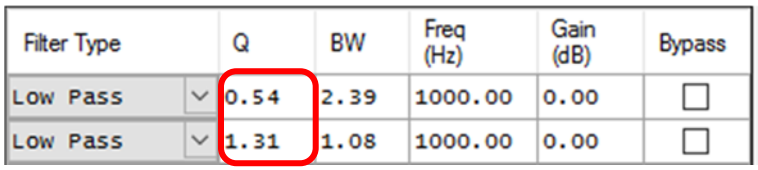

Figure 1 – Butterworth 4th Order 1000Hz Low Pass