Digital Multiband Processing

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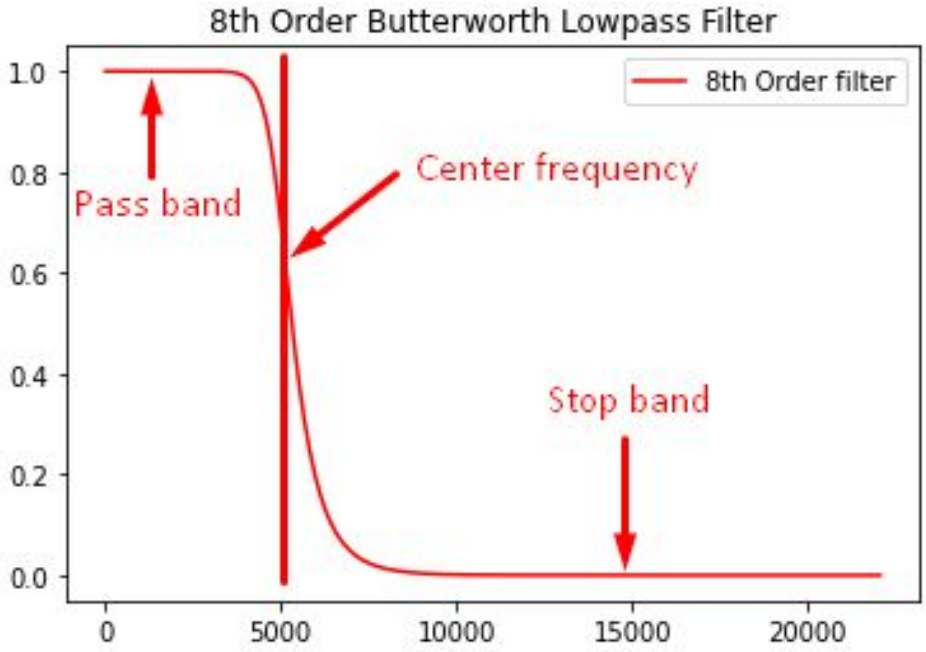
Filter primer

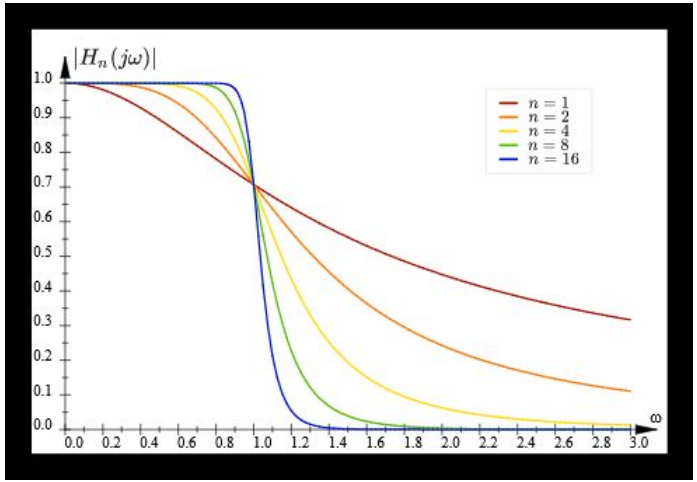


Characteristics of Crossover Filter

- Frequency response flat in Pass band
- Frequency response flat in Stop band
- Lowpass and Highpass variants should sum to flat response

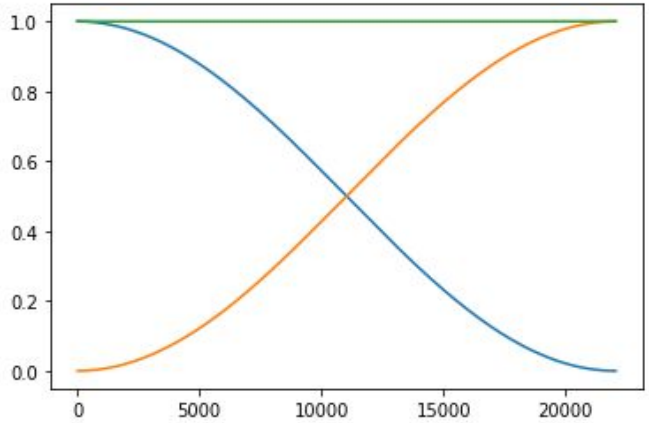
Butterworth Filter

- IIR Filter
- Flat frequency response in the pass band
- Flat frequency response in the stop band
- -3db at center frequency

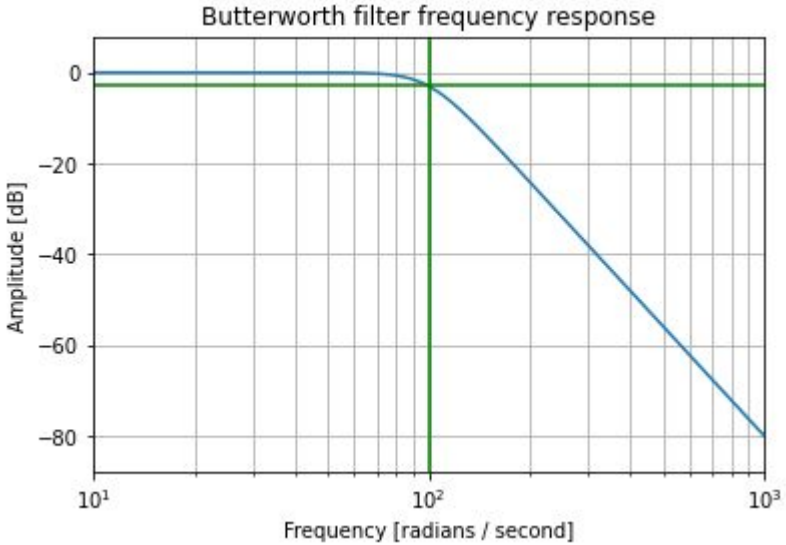


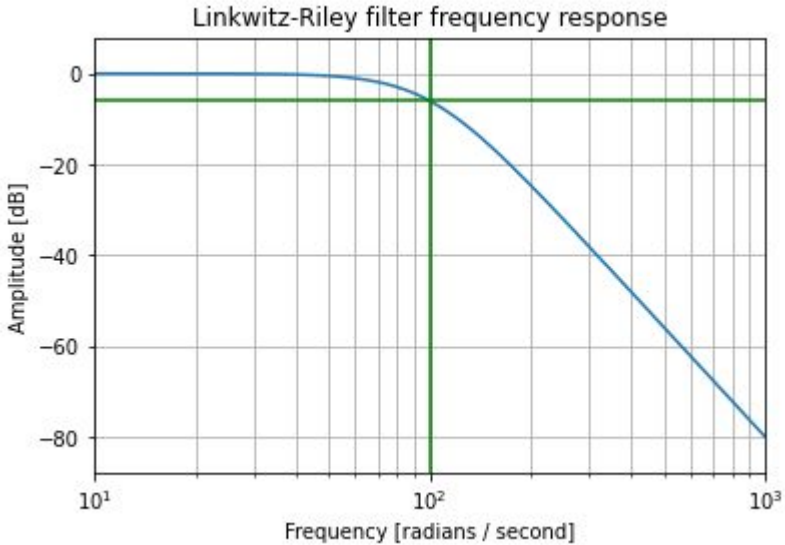
Linkwitz-Riley Filter

- IIR Filter
- Flat frequency response in the pass band
- Flat frequency response in the stop band
- -6db at center frequency
- Lowpass and Highpass at same frequency sum to a flat frequency response



Frequency Response Comparison



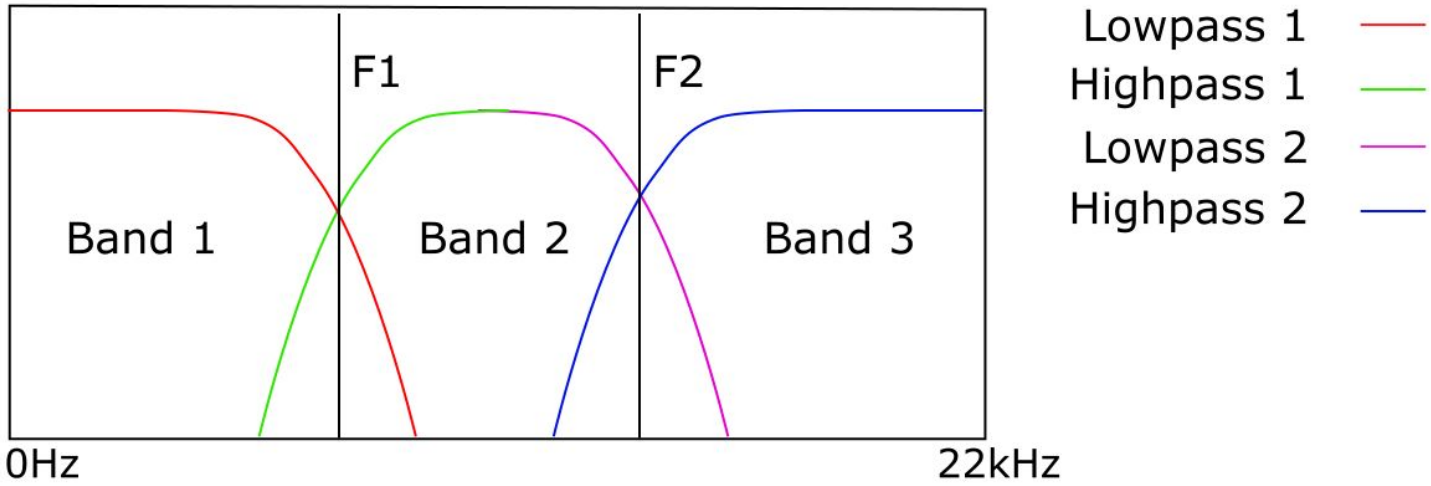


Alternatives

FIR Filter

- No phasing issues
- Difficult to construct
- Requires more CPU time

Crossover construction



Band 1 = Signal -> Lowpass 1 -> Allpass 1 (at F2)
Band 2 = Signal -> Highpass 1 -> Lowpass 2
Band 3 = Signal -> Highpass 1 -> Highpass 2

Demo Plugin

https://github.com/abaga129/BandanaSplit

Sources

https://tttapa.github.io/Pages/Mathematics/Systems-and-Control-Theory/Analog-Filters/Butterworth-Filters.html

https://stackoverflow.com/questions/21576539/how-do-i-cascade-two-second-order-butterworth-filters

Pirkle, W. (2012). Designing audio effect plug-ins in C++: With digital audio signal processing theory. Focal Press.