The Modified Chamberlin and Zölzer Filter Structures

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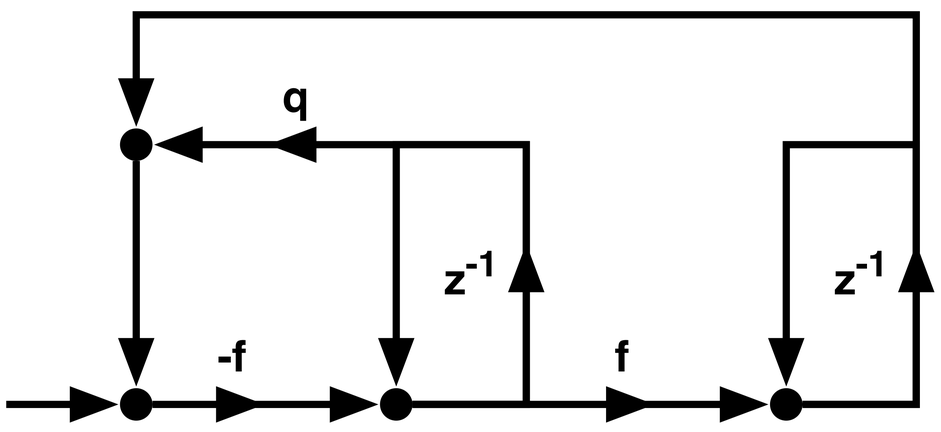
DAFx-06, Montréal
Poster Session 1

Focus on Modified Chamberlin

Chamberlin (a.k.a. Kingsbury)

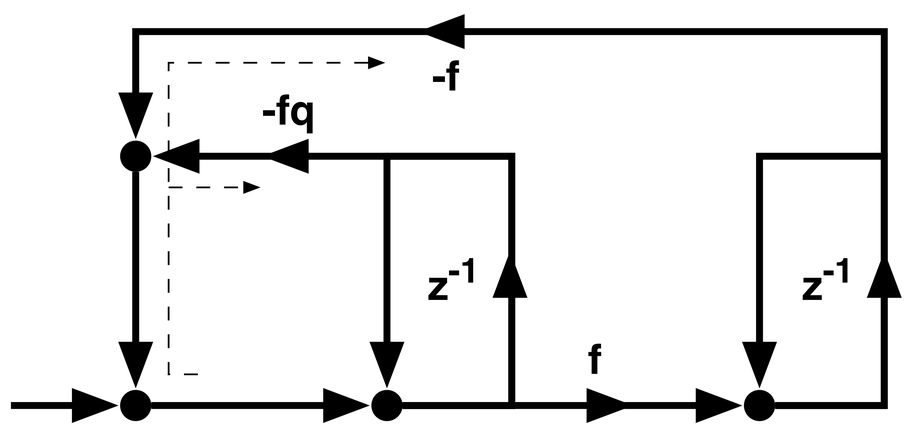


Node 1,
2 transmission zeros

Node 2,
1 transmission zero

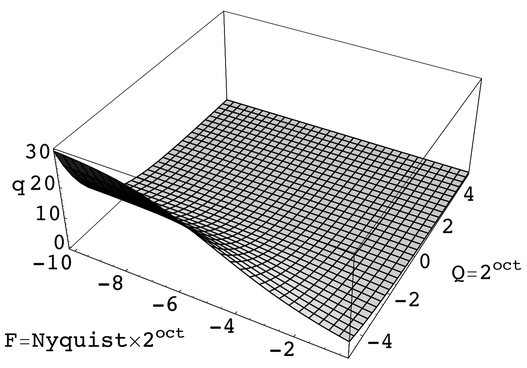
Node 3,
all-pole

Modified Chamberlin

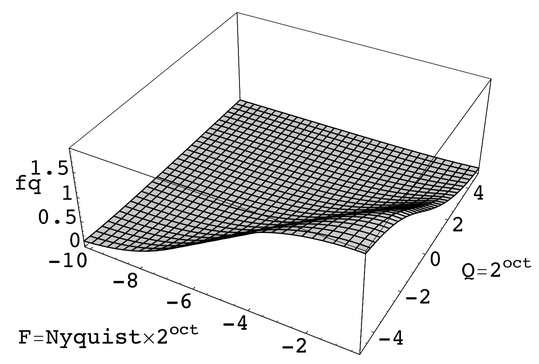


- Move -f multiplier in direction opposite of signal flow.
- Yields similar structure with same transmission zero profile.
- Chamberlin q coefficient replaced by fq = f × q

Range of q/fq Coefficient



- Tuning range employed herein: bandpass transfer function, center frequency 10 octaves starting at 20Hz / 24kHz, Q logarithmically scaled from 1/32 to 32.
- The f coefficient value is equivalent for both Chamberlin and Modified Chamberlin.

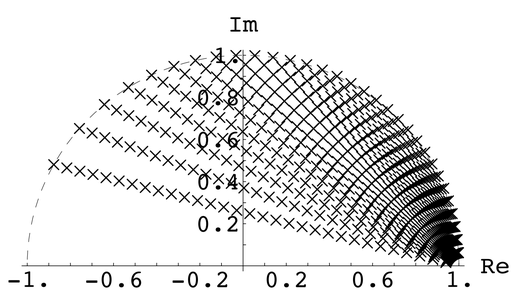


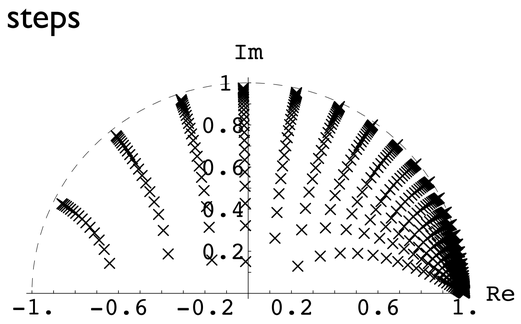
- The q coefficient can be large in magnitude for low frequency and Q parameters.
- The maximum value of the q coefficient is theoretically boundless.

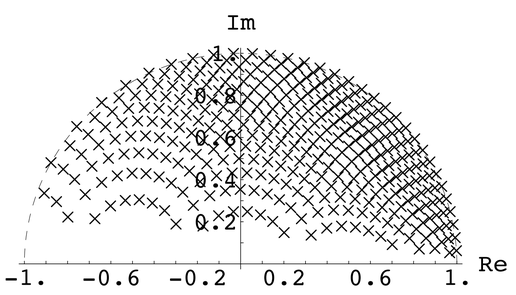
- The fq coefficient range is significantly less than that of the Chamberlin q.
- The maximum stable range of the fq coefficient is 0 to 2, which can be represented in an unsigned fixed point DSP word without special treatment.

Distribution of Poles

- The ideal pole distribution for this tuning range, in logarithmic steps



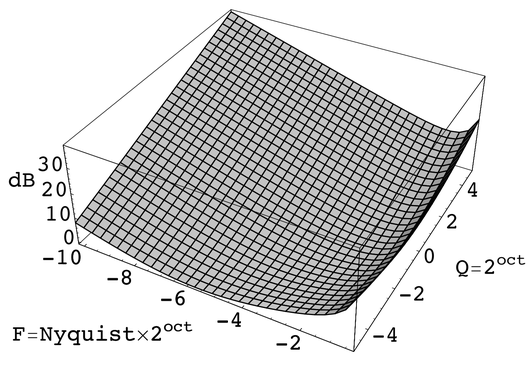




- Pole density increases towards DC.
- Pole density hole at Nyquist.

- Pole density increases towards DC, though less pronouced than Chamberlin.
- Pole density hole at Nyquist filled in to a limited extent.

Noise Gain from Node 3 to Node 1



- Additional factor of f lowers quantization noise flowing into Modified node 1 over most of the tuning range.
- However, the signal level at Modified node 1 is 1/f that of the other nodes, relatively speaking.