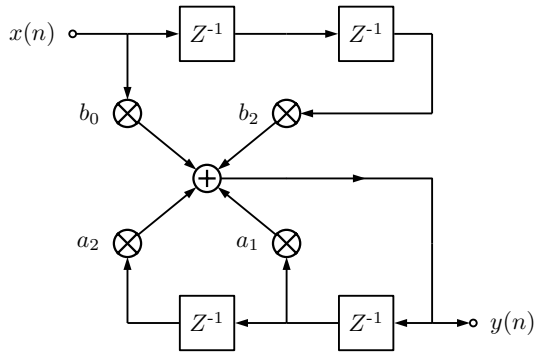
The Exactly-Tuned Resonator

A. D. Levine
dl@acm.org

The second-order bandpass resonator designed by this author, with a closed-form solution precisely placing peak unity gain and zero-phase response at passband geometric center frequency:



$$
\begin{aligned}
f_c &\triangleq \sqrt{f_{hi} f_{lo}} \\
\theta &\triangleq 2\pi f_c / f_s \\
B_f &\triangleq (f_{hi} - f_{lo}) / f_c \\
a_2 &\triangleq -\exp(-\theta B_f) \\
a_1 &\triangleq \cos(\theta)(1 - a_2) \\
b_0 &\triangleq \tfrac{1}{2}(1 + a_2) \\
b_2 &\triangleq -b_0
\end{aligned}
$$