The two filter zeros are;

$$z_{\pm} = f_z \left[\frac{1}{2Q} \pm i \sqrt{\left(1 - \frac{1}{4Q^2} \right)} \right], \tag{1}$$

with center frequency f_z in a similar fashion to eq. (61) in Malik's document (T000134), but in terms of an arbitrary quality factor Q. The poles are;

$$p_{\pm} = \frac{f_0}{2} \pm i \frac{\sqrt{3} f_0}{2} \tag{2}$$

based only on the observed free eigenmode f_0. In the above,. The filter transfer function is evaluated as

$$H(f) = \frac{-f^2 + f_z^2 - i f f_z / Q}{-f^2 + f_0^2 - i f f_0}, \tag{3}$$

from which we can constrain the DC gain (0 Hz) to satisfy condition (1) above by using the limit

$$\lim_{f \to 0} H(f) = f_z^2 / f_0^2 \tag{4}$$

giving $f_z = f_0 \sqrt{G_{\mathrm{DC}}}$ in terms of the observed eigenfrequency. By pulling a $-f^2$ from both the numerator and the denominator in $H(f)$ we obtain an alternative form

$$H'(f) = \frac{1 + i f_z / f Q - f_z^2 / f^2}{1 + f_0 / f - f_0^2 / f^2}, \tag{5}$$

for which the limit

$$\lim_{f \to \infty} H'(f) = 1 \tag{6}$$

fullfills condition (2) for the high-frequency AC gain. Below are a set of evaluated filter TFs for different values of Q.

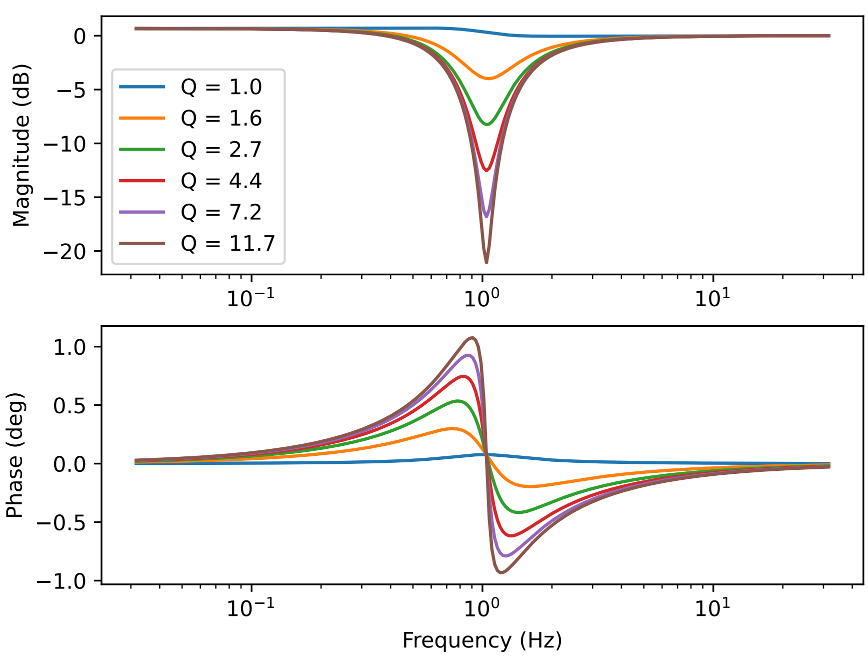

Figure 1: With higher values of Q, the filters approach a single notch. The DC and high-frequency gain constraints are always fulfilled. Here we assume 1.08 for the DC gain, and $f_0 = 1\,\mathrm{Hz}$.