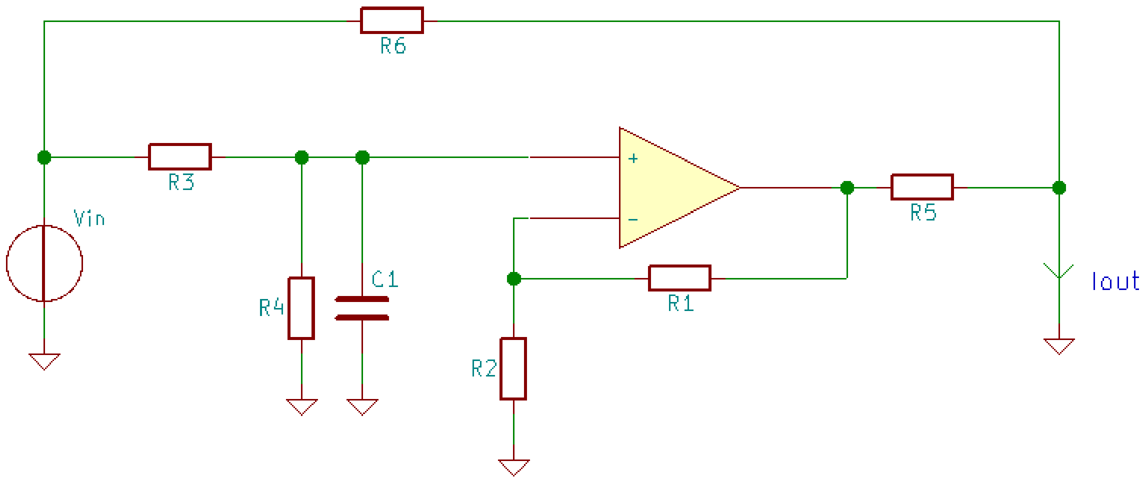

Figure 1 Gary Galo's and D.M. Shields's bass correction network, see Gary Galo, "An archival phono preamplifier", Linear Audio vol. 5, pages 77...104

Assumptions: everything ideal, gain doesn't matter much, the zero and the pole realized by this circuit have to be very accurately put on certain desired locations by setting R_4 and R_5 (all other component values are fixed in Gary Galo's design).

$$I_{out} = \frac{V_{in}}{R_6} + V_{in} \frac{R_4}{R_3+R_4} \cdot \frac{1}{s\frac{R_3 R_4}{R_3+R_4}C_1+1} \cdot A \cdot \frac{1}{R_5}$$

$$\frac{I_{out}}{V_{in}} = \frac{1}{R_6} + \frac{R_4}{R_3+R_4} \cdot \frac{1}{s\frac{R_3 R_4}{R_3+R_4}C_1+1} \cdot A \cdot \frac{1}{R_5}$$

where $A = 1 + R_1/R_2$.

The pole lies at $s = -\frac{1}{\frac{R_3 R_4}{R_3+R_4}C_1}$. The second term of the expression for I_{out}/V_{in} goes to infinity for s approaching this value, the first term stays finite, so the sum also goes to infinity. Hence, the first corner frequency is $F_3 = \frac{1}{2\pi\frac{R_3 R_4}{R_3+R_4}C_1}$ and the first time constant $T_3 = \frac{R_3 R_4}{R_3+R_4}C_1$, exactly as described by Gary Galo. Rearranging this last equation results in his equation $R_4 = \frac{R_3 T_3}{R_3 C_1 - T_3}$.

When the zero is called s_z, by definition, at $s = s_z$, the transfer is zero. Hence,

$$0 = \frac{1}{R_6} + \frac{R_4}{R_3+R_4} \cdot \frac{1}{s_z\frac{R_3 R_4}{R_3+R_4}C_1+1} \cdot A \cdot \frac{1}{R_5}$$

Multiplying everything by R_5 and putting one term on the other side of the equal sign:

$$\frac{R_5}{R_6}=-\frac{R_4}{R_3+R_4}\cdot\frac{1}{s_z\frac{R_3 R_4}{R_3+R_4}C_1+1}\cdot A$$

$$\frac{R_5}{R_6}=-\frac{R_4 A}{s_z R_3 R_4 C_1+R_3+R_4}$$

Substituting $s_z = -2\,\pi\,F_4$ to match Galo's notation:

$$R_5=\frac{R_4 R_6 A}{2\pi F_4 R_3 R_4 C_1-R_3-R_4}$$

Dividing numerator and denominator by R_4 and writing $R_3C_1 = 1/(2\,\pi\,F_{3\text{min}})$ to make it look more like Galo's equation on page 91 of the article:

$$R_5=\frac{R_6 A}{2\pi F_4 R_3 C_1-\frac{R_3}{R_4}-1}=\frac{R_6 A}{\frac{F_4}{F_{3\text{min}}}-\frac{R_3}{R_4}-1}$$

The numerator equals the numerator of Galo's equation, the weird factor $F_3 + 1$ in the first term of the denominator has changed into $F_{3\text{min}}$ and there is an extra term $-R_3/R_4$.

This extra term can be expressed as a function of F_3 and $F_{3\text{min}}$, if so desired. Using

$$R_4=\frac{R_3 T_3}{R_3 C_1-T_3}$$

$$\frac{R_3}{R_4}=\frac{R_3 C_1-T_3}{T_3}=\frac{\frac{1}{2\pi F_{3\text{min}}}-\frac{1}{2\pi F_3}}{\frac{1}{2\pi F_3}}=F_3\left(\frac{1}{F_{3\text{min}}}-\frac{1}{F_3}\right)=\frac{F_3}{F_{3\text{min}}}-1$$

one finds

$$R_5=\frac{R_6 A}{\frac{F_4}{F_{3\text{min}}}-\frac{R_3}{R_4}-1}=\frac{R_6 A}{\frac{F_4}{F_{3\text{min}}}-\frac{F_3}{F_{3\text{min}}}}$$

The term - 1 in the denominator of Galo's equation has changed into - $F_3/F_{3\text{min}}$. As Galo never introduced a symbol for the "base frequency" $F_{3\text{min}}$ but used the same symbol as for F_3, it is quite possible that he mixed up F_3 and $F_{3\text{min}}$ and thought their ratio was 1.