LC Filter Design Using Equal Value R Gyrator

The following equations calculate the C values for a defined R, Q, and FO. This is to be used for the form of gyrator that uses equal value R's and a single opamp/follower.

Where...

\( FO = \) resonate frequency in Hertz
\( R = \) value of the two resistors in Ohms
\( Q = FO/\text{Bandwidth} \)

\( FO = 270 \)
\( Q = 1 \)
\( R := 1000 \)

\( CS \) is the \( C \) value for the LC filter

\[
CS := \frac{1}{(4 \cdot \pi) \cdot R \cdot Q \cdot FO} \quad CS = 2.947 \times 10^{-7} \quad \text{or} \quad 0.294 \text{ mfd}
\]

\( CI \) is the \( C \) value for the Gyrator that simulates the \( L \) in the LC filter

\[
CI := \frac{Q}{\pi \cdot R \cdot FO} \quad CI = 1.179 \times 10^{-6} \quad \text{or} \quad 1.179 \text{ mfd}
\]

So to build a LC filter with \( Q = 1 \), center freq = 270 Hz, and using 1k resistors, use a 0.294 mfd in series with the gyrator which uses a 1.179 mfd cap.

To prove the above...

\[
FO := \frac{1}{(2 \cdot \pi) \cdot R \cdot \sqrt{CS \cdot CI}}
\]

\( FO = 270 \)