From normalized coupling matrix to a network with coupled resonators

3 Resonators
No Tx zeros at finite frequencies
22 dB Return Loss
f_1 = 550 MHz
f_2 = 560 MHz

(N+2) coupling matrix (normalized):

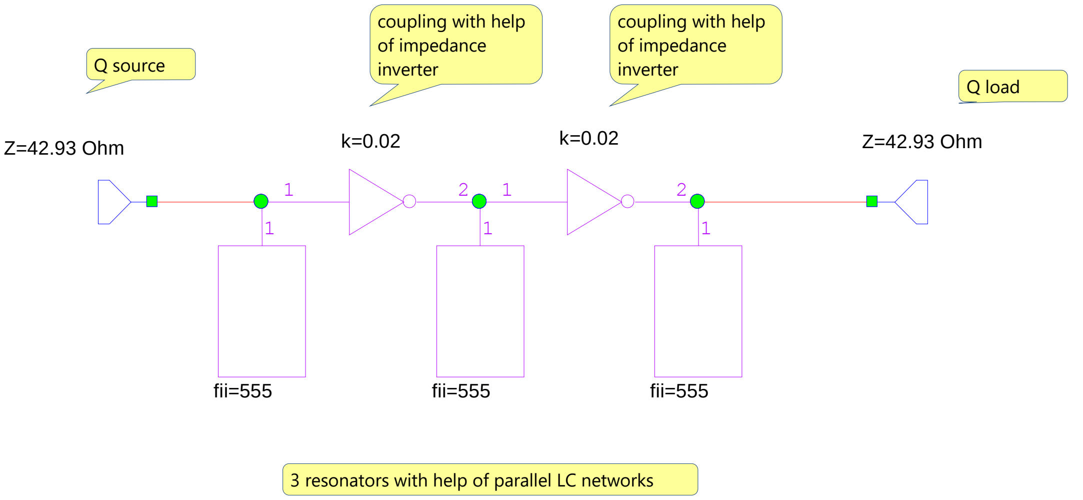
$$M = \begin{bmatrix} 0 & 1.1376 & 0 & 0 & 0 \\ 1.1376 & 0 & 1.1010 & 0 & 0 \\ 0 & 1.1010 & 0 & 1.1010 & 0 \\ 0 & 0 & 1.1010 & 0 & 1.1376 \\ 0 & 0 & 0 & 1.1376 & 0 \end{bmatrix}$$

For denormalizing we need f_0 and the fractional bandwidth *FBW*:

$$f_0 = \sqrt{f_1 \cdot f_2} \approx 555\,\text{MHz}, \quad FBW = \frac{\Delta f}{f_0} \approx 0.0180$$

- The 3 resonators are synchronously tuned (main diagonal)
- coupling from resonator 1 to resonator 2 is calculated as follows: $k_{12} = FBW \cdot M_{23} = 0.02$
- coupling from resonator 2 to resonator 3 is calculated as follows: $k_{23} = FBW \cdot M_{34} = 0.02$
- loaded Q from source and load: $Qs = \dfrac{1}{FBW \cdot M_{12}^{\;2}} = 42.93, \quad Q_L = \dfrac{1}{FBW \cdot M_{56}^{\;2}} = 42.93$

This leads to the following equivalent circuit:

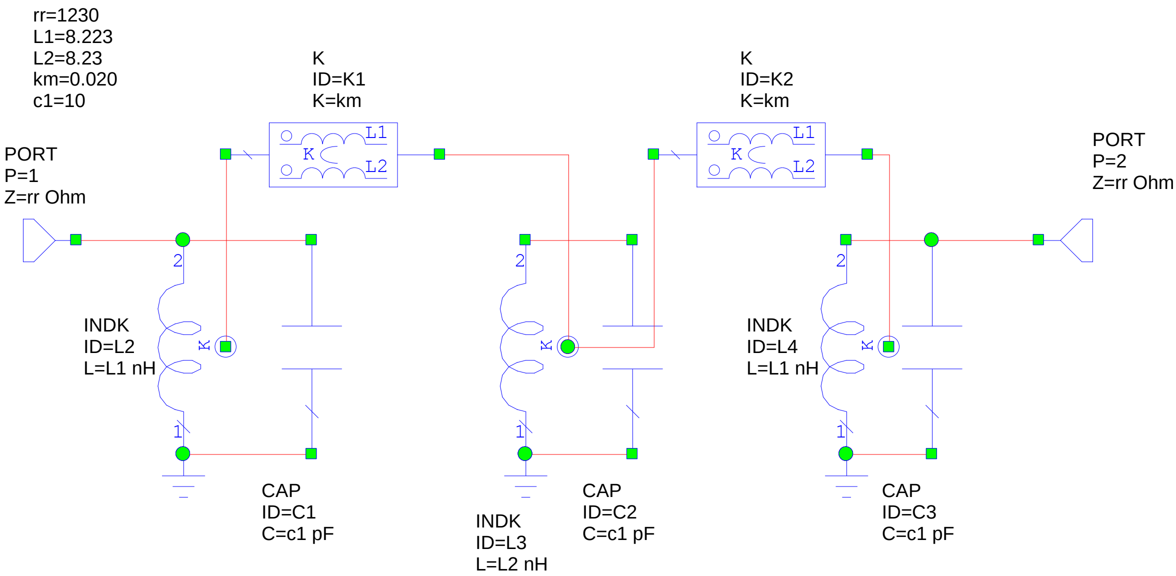


Please note:
That's only a "high level" schematic. There is no information, how the coupling is realized. E.g. you can use capacitive, magnetic or inductive coupling. The "impedance level" of the resonators is also not yet defined.

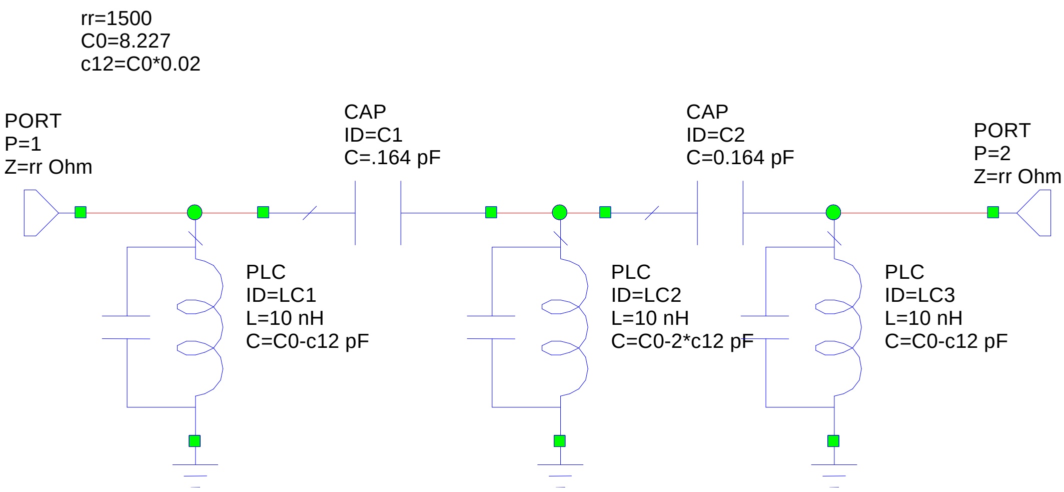
The following schematics show possible "realizations" oft he filter. But there's still a lot of work from here to a physical realization.

Last remark: This is still a simple example without cross-couplings.

Magnetic coupling



Capacitive coupling



Inductive coupling