Approximation with the characteristic funktion K

$$|S_{21}|^2 = \frac{1}{1+|K|^2} = \frac{1}{1+\left|\frac{F}{P}\right|^2} = \frac{|P|^2}{|F|^2+|P|^2} \qquad |S_{11}|^2 = \frac{|K|^2}{1+|K|^2} = \frac{|F|^2}{|F|^2+|P|^2}$$

F, P: polynomials with real coefficients and no restrictions for the zeros

Zeros of F: reflection zeros $\quad (|S_{21}| = 1 \Rightarrow 0\,\mathrm{dB}\ !!!)$

Zeros of P: transmission zeros $\quad (|S_{21}| = 0 \Rightarrow -\infty\,\mathrm{dB})$

Example
Passband: 5.7 – 5.9
Return Loss: 22 dB
3 Resonators

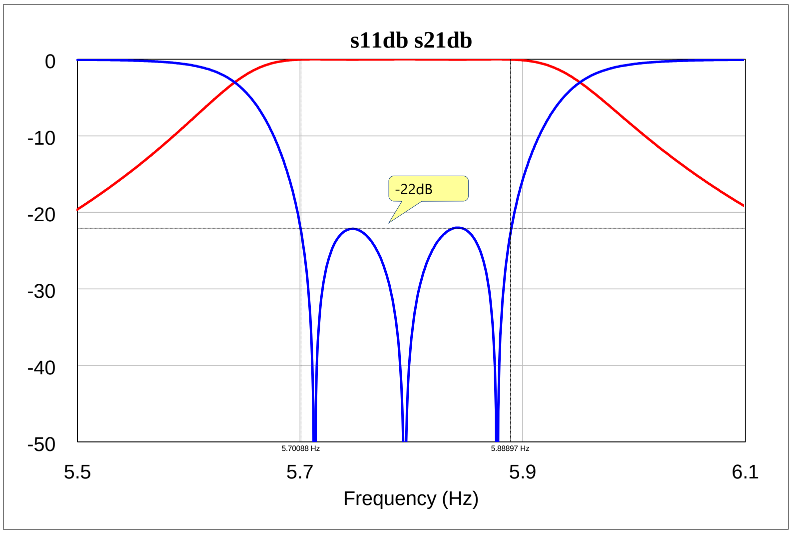
Reflections zeros: 5.713, 5.794, 5.877 → $F(s) = (s^2+\Omega_1^2)\cdot(s^2+\Omega_2^2)\cdot(s^2+\Omega_3^2)$

Transmission zeros: $P(s) = p_0 \cdot s^3$

"Rippel factor": $p_0 = 0.0215$

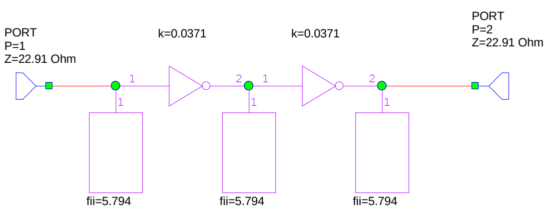
$$|K|^2 = \left|\frac{(-\Omega^2+\Omega_1^2)\cdot(-\Omega^2+\Omega_2^2)\cdot(-\Omega^2+\Omega_3^2)}{p_0\cdot(j\Omega)^3}\right|^2$$

Make a plot of s11db, s21db and tune the parameter (reflection zeros and p_0) leads to the result:



Next step: coupling matrix (normalized)

0	1,1376	0	0	0
1,1376	0	1,101	0	0
0	1,101	0	1,101	0
0	0	1,101	0	1,1376
0	0	0	1,1376	0



Next step: conversion to physical dimensions.