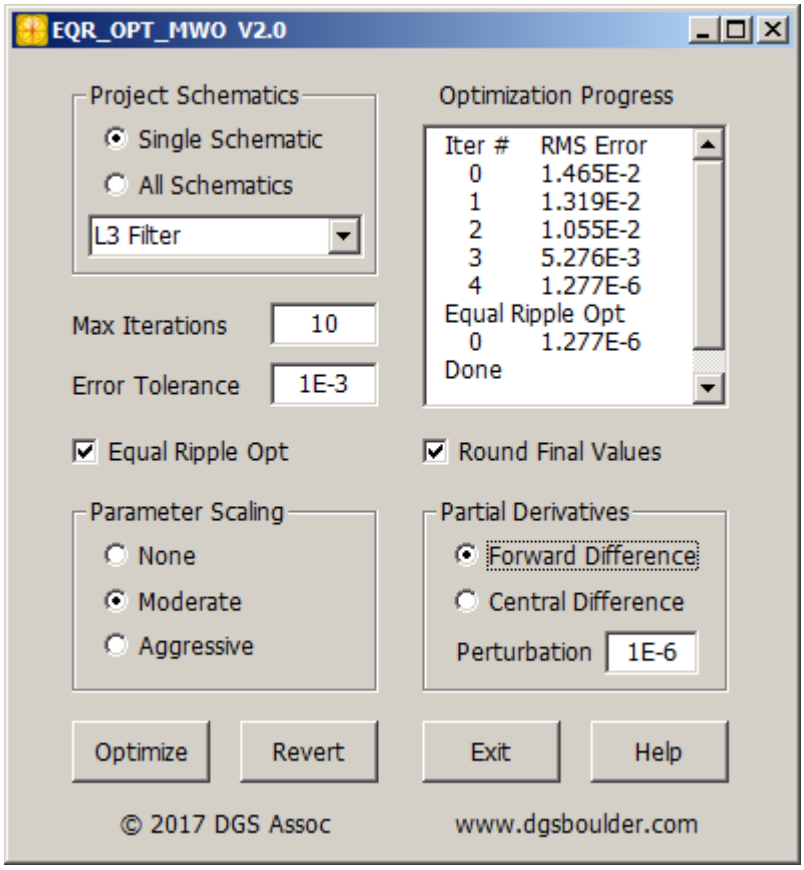
Equal Ripple Optimization for NI AWR MWO



Equal Ripple Optimization for NI AWR Microwave Office (EQR_OPT_MWO) is a specialized engine for filter optimization. It leverages the AWRDE COM Automation API and can optimize any filter that can be defined in the Microwave Office design environment. It can also be used to port tune S-parameter files imported from any EM simulator. Unlike many general purpose optimizers, EQR_OPT_MWO finds an exact equal ripple response. General purpose optimizers often fail to find all the reflection zeros in the passband, particularly for higher order filters.

EQR_OPT_MWO can optimize individual bandpass, lowpass and highpass filters. It can also optimize diplexers and multiplexers. Once an initial solution is found, it is easy to modify the bandwidth or shift the center frequency of the filter. Variables can be used in schematics and constraints on element values are supported.

Key Features

- Exact equal ripple optimization of any bandpass, lowpass or highpass filter.
- Exact equal ripple optimization of diplexers and multiplexers.
- Supports port tuning of imported S-parameter files from EM simulators.
- Access to all the library elements in the NI AWR design environment.
- Compatible with NI AWR iFilter.
- Example files for many filter topologies are included.
- Tested and supported on 32 and 64 bit versions of Windows XP and Windows 7 thru 10.

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Example 1: Edge coupled microstrip filter using analytical models

Any combination of analytical models or EM based models from the AWRDE element library can be used in the filter schematic. In this case we are using analytical models to describe an N=5 edge coupled filter in microstrip. Ten variables are needed to define the resonator frequencies, the coupling between resonators and the return loss level. NI AWR iFilter could be used to find starting values for the optimization.

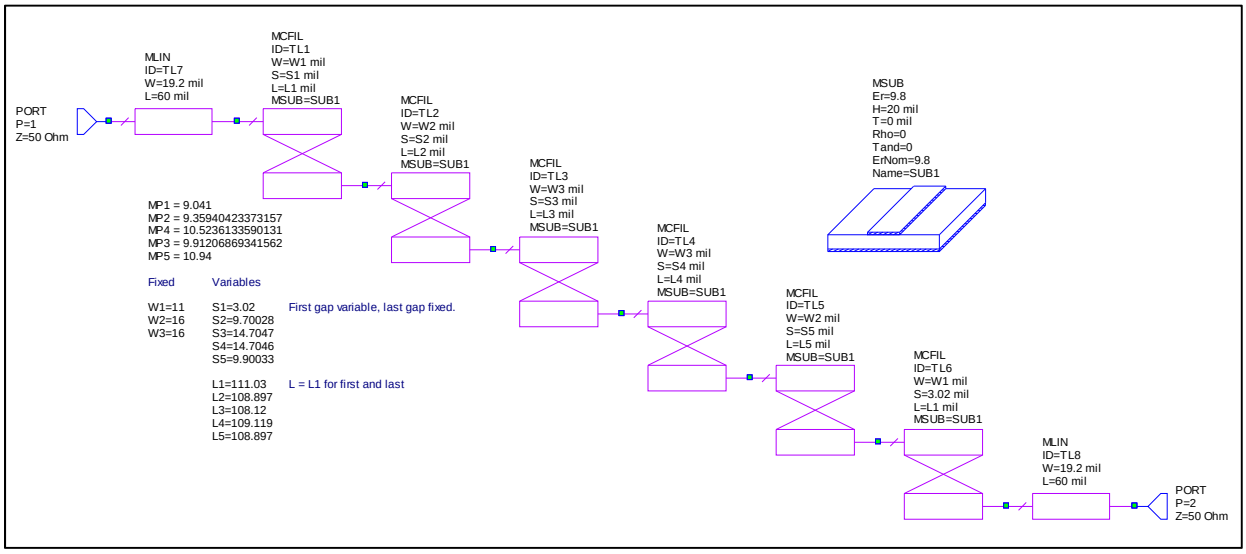


Figure 1. AWRDE schematic for an edge coupled filter.

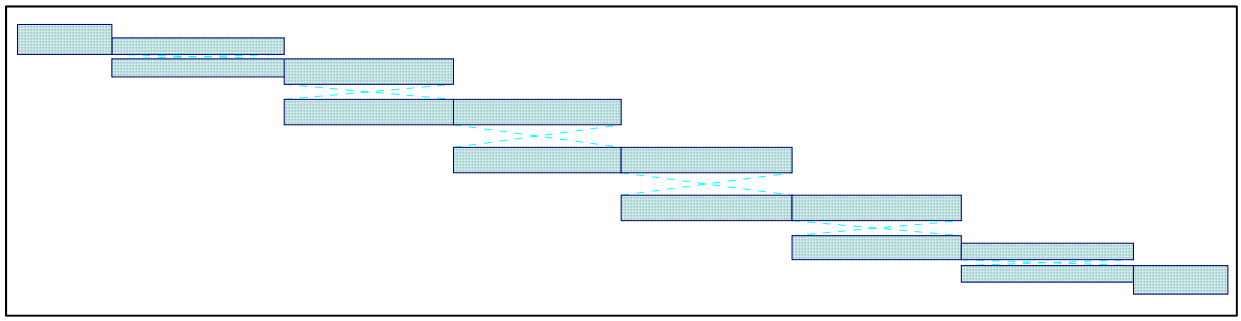


Figure 2. Edge coupled filter layout.

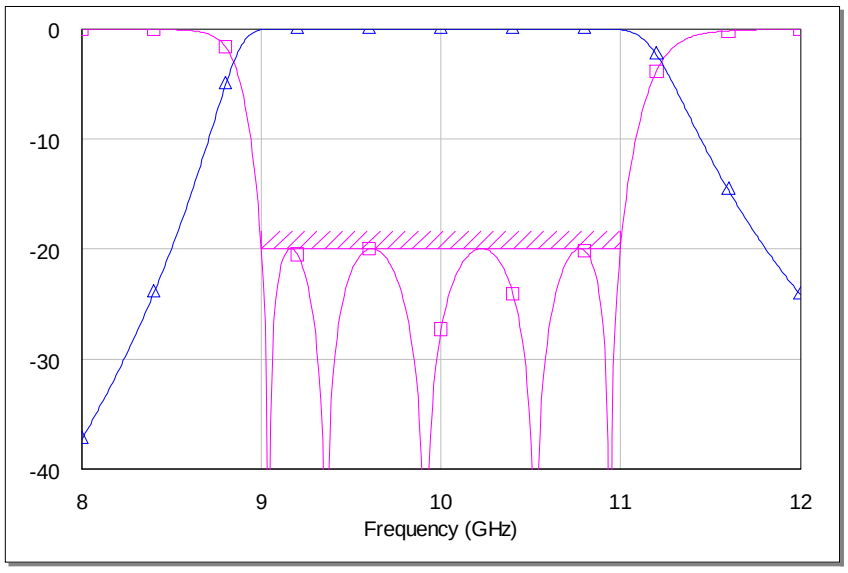


Figure 3. Optimized equal ripple filter response.

Example 2: Port tuned microstrip edge coupled filter

It is important to include housing effects in any thin-film distributed filter. We might use analytical models to find a good starting point, but then we typically turn to EM simulation of the complete filter in the housing. In this example we demonstrate port tuning of an N=5 microstrip filter that has been simulated in Sonnet ***em***.

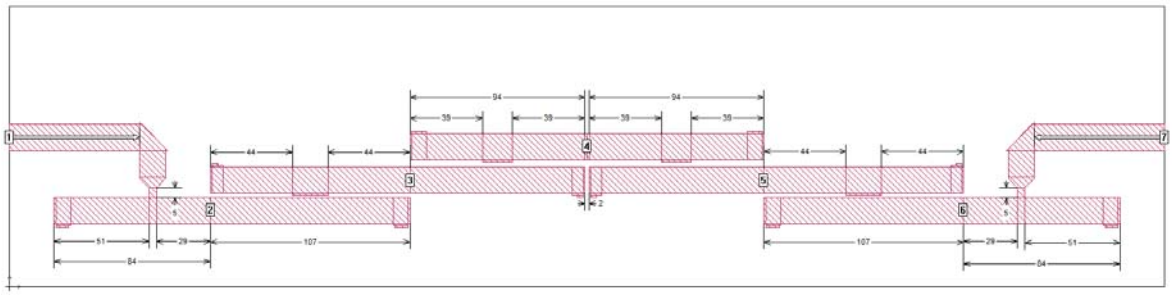


Figure 4. Filter layout in Sonnet ***em*** with housing and tuning ports.

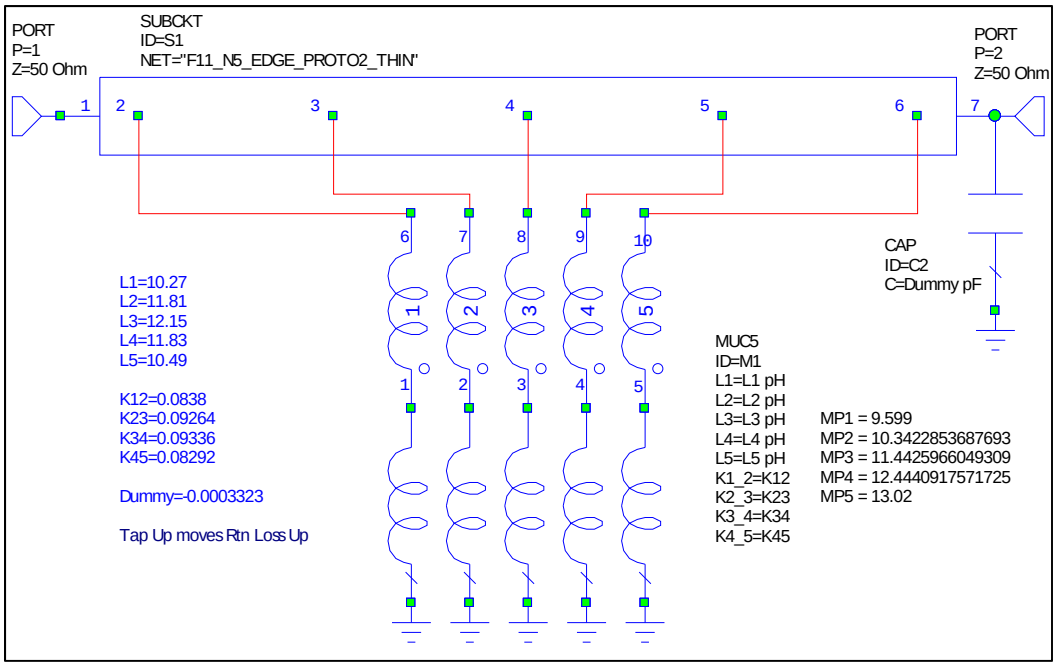


Figure 5. AWRDE schematic for port tuning the edge coupled filter.

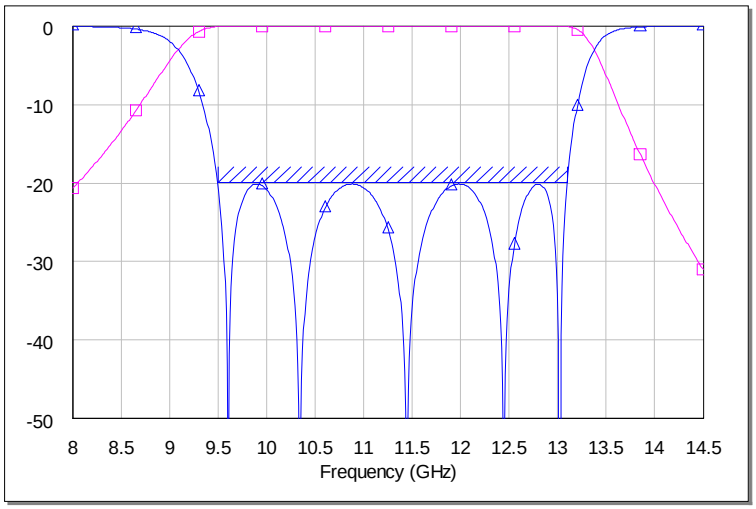


Figure 6. Optimized equal ripple filter response.

Example 3: Port tuned waveguide filter with cross coupling

Port tuning can also be applied to cavity combline and waveguide filters. This example is an N=11 folded waveguide filter with a quad type cross coupling modeled in ANSYS HFSS. In this type of problem, general purpose optimizers will typically find 8 or 9 reflection zeros in the passband, but they typically will not find all 11.

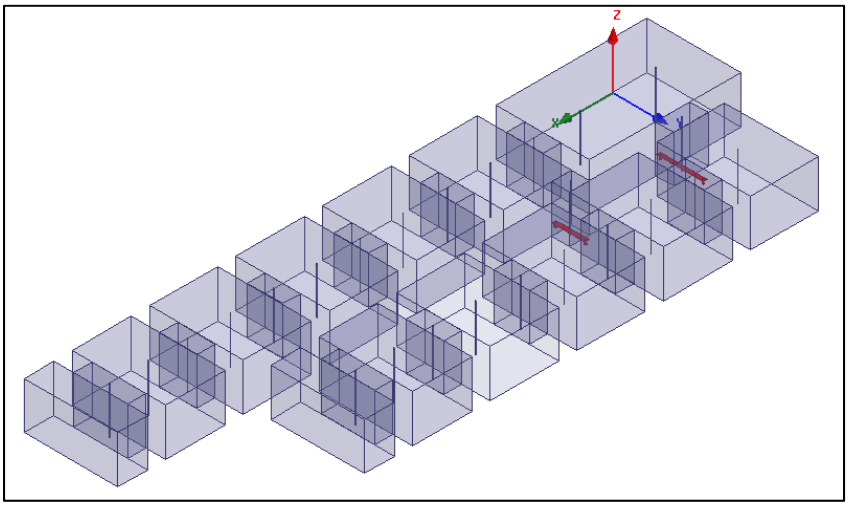


Figure 7. N=11 cross coupled waveguide filter modeled in ANSYS HFSS.

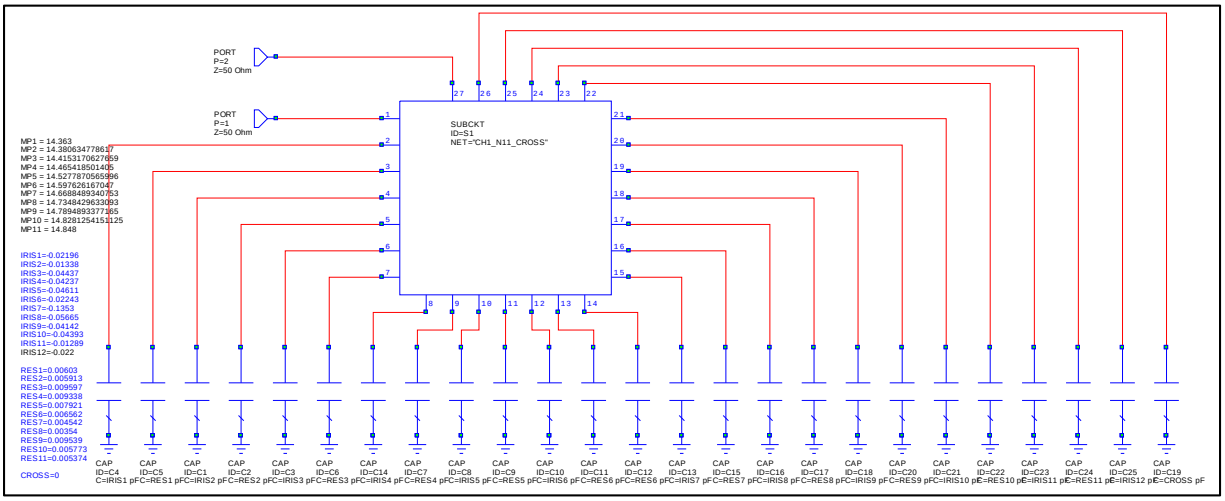
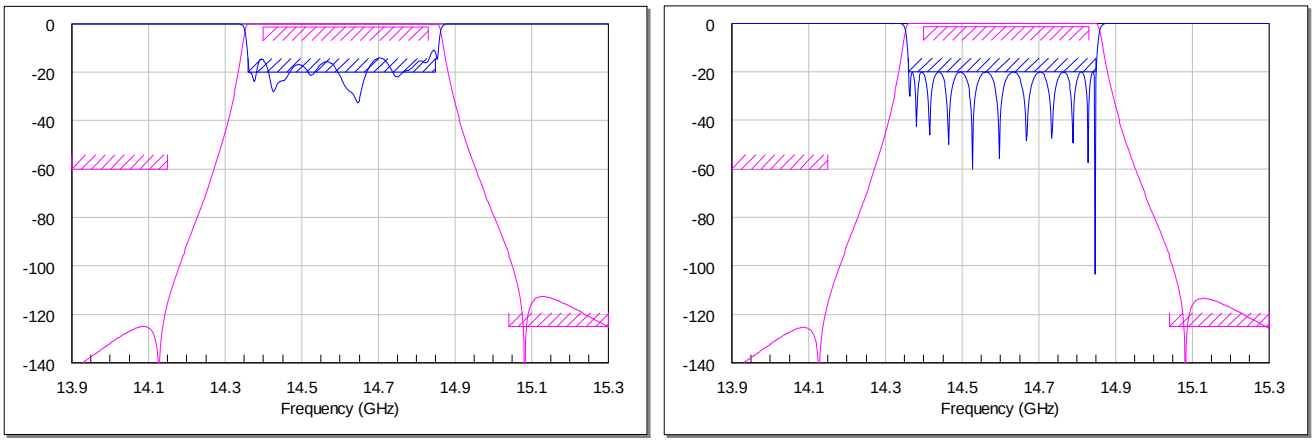


Figure 8. AWRDE schematic for port tuning the waveguide filter.



(a) (b)

Figure 9. (a) Filter with one resonator and one coupling detuned and (b) after equal ripple optimization.

