Gain Flattening Filter Optimization

OptiSystem Application Note



Gain Flattening Filter Optimization

1. Introduction

The system layout is presented in Figure 1. The WDM Transmitter generates eight channels from 195 THz to 196.4 THz, with power of -20 dBm per channel. The Gain Flattening Filter component is placed after the EDFA and it will equalize the amplifier gain.

The user can change the filter parameters manually or use the Gain Flattening Filter Optimization of OptiSystem. The optimization engine is built specifically for the Gain Flattening Filter component and the Dual Port WDM Analyzer. Both modules must be present in the layout in order to use the optimization. The filter can be placed anywhere in a layout, for example, between two stages of an optical amplifier.



Figure 1 – System layout

2. Accessing the optimization

Figure 2 shows the steps to access OptiSystem optimization dialog box.

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Figure 2 – Accessing the optimizations

3. Setting up the optimization

Figure 3 shows the main parameters of the optimization. The optimization will run 10 times, targeting a gain ripple of 0.1 dB from 1500 to 1600 nm. The minimum transmission value for the filter is -40 dB and the maximum value is -0.1 dB. The transmission values of the filter will be optimized at the user defined frequencies defined in the filter.

The components tab should have the filter component and the visualizers tab should have the dual port analyzer (Figures 4 and 5).

GFFrO Setup		×
Optimization Name: Gain FFr Optimization		Generate
Main Components Visualizers		
Optimization Maximum number of sto Minimum transmission va Maximum transmission va Wavelength fro	ps: 10 ue: -40 (dB) ue: -0.1 (dB) m: 1500 (nm) General Info Author: Optiwave Version: 1.0 Copyright: Optiwave Description: Gain FFr Optimization	
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Figure 3 – Main parameters.

GFFrO Setup		×
GFFrO Setup Optimization Name: Gain FFr Optimization Main Components Visualizers Layout United Structure Components Dual Port WDM Analyzer Def Dual Port WDM Analyzer Def	Selected Component Gain Flattening Filter	Component << Delete Add >>
Optical Spectrum Analyzer_4 Optical Spectrum Analyzer_5 Optical Spectrum Analyzer_6 Optical Spectrum Analyzer_7 Optical Spectrum Analyzer_8 Optical Spectrum Analyzer_9 Optical Spectrum Analyzer_9 WDM Demux ES WDM Mux ES WDM Transmitter		
	OK Cancel	

Figure 4 – Components tab.

GFFr0 Setup		X
Optimization Name: Gain FFr Optimization		Generate
Main Components Visualizers		
Layout EDFA Gain Flattening Filter Optical Spectrum Analyzer_1 Optical Spectrum Analyzer_10 Optical Spectrum Analyzer_2 Optical Spectrum Analyzer_3 Optical Spectrum Analyzer_3 Optical Spectrum Analyzer_4 Optical Spectrum Analyzer_5 Optical Spectrum Analyzer_6 Optical Spectrum Analyzer_7 Optical Spectrum Analyzer_8 Optical Spectrum Analyzer_9 VDM Demux ES WDM Mux ES WDM Transmitter	Selected Visualizer Dual Port WDM Analyzer	Visualizer << Delete Add >>
	,	
	OK Cancel	

Figure 5 – Visualizers tab.

4. Running the optimization

In order to run the optimization, simply calculate the project. Make sure the 'Run all optimizations' check box is enabled. During the calculation the user can click on the Optimization tab and visualize the progress of the optimizations (Figure 6).

Gain Flattening Filter Optimization.osd					
 Calculate the whole project Calculate all sweep iterations in ac Calculate current sweep iteration Ready 	tive layout	Optimizations Schedulers Run all optimizations Stop on warning Display Messages 00:00:15			
Component:		Visualizer:			
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Transmission[0] Transmission[1] Transmission[2] Transmission[3] Transmission[0] Transmission[1] Transmission[2] Transmission[3]	-0.1 -0.1 -0.1 -0.882414 -4.87146 -4.80107 -0.1	Gain ripple Gain ripple	4.77146 0.00172623		
Calc. output Defimization Calc. schedulers					

Figure 6 – Optimizing the filter.

5. Graphs and result

In this particular project we have the signal before and after the gain flattening filter available in the report page (Figure 7). The shape of the filter is also available in the report. The user can also visualize the overall gain of the amplifier using the WDM analyzer (Figure 8) and the value of the filter transmission values by looking at the filter parameters (Figure 9).



Figure 7 – Signals before and after the filter.

requency (THz)	Gain (dB)	Noise Figure (dB)	🔄 🛯 Signal Index: 🕛 🛛 🛁
195	26.432104	3.68884	- Frequency
195.2	26.204797	3.96415	- Frequency
195.4	26.433484	4.02328	- Units: THz 💌
195.6	26.326436	3.33864	
195.8	26.188743	3.1669	Power
196	26.433744	2.96514	
196.2	26.911837	2.57985	Units: dBm 💆
196.4	26.432018	1.8782	
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1			
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Figure 8 – The total gain of the EDFA+GFF system.

Gain Flat	tening Filter I	Properties						×
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	Transmissio	n[1]	-4.	8714559812	11 dB	Optimiz	e	
	Transmissio	n[2]	-4.	8010653019	84 dB	Optimiz	e	
	Transmissio	n[3]		-	0.1 dB	Optimiz	e	
								Load Save As Security
							 ▼	Help

Figure 9 – Filter transmission value.



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