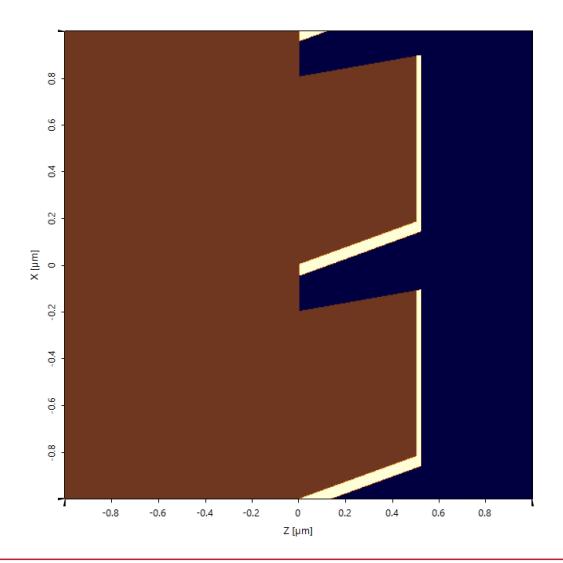


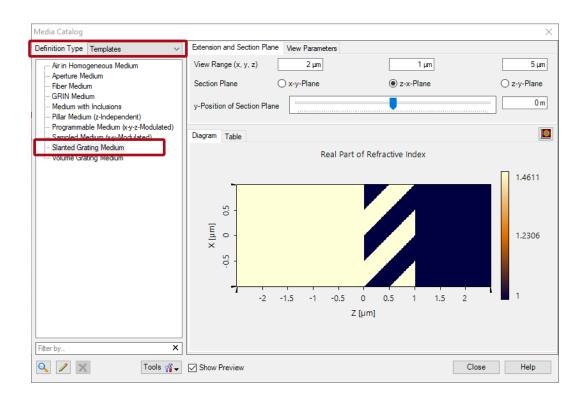
Advanced Configuration of Slanted Gratings

Abstract



VirtualLab can be used to analyze arbitrary types of gratings. Due to the raising importance of gratings which exhibit slanted structures within complex optical setups also slanted gratings are available. The slanted grating is realized by an special optical medium, where the geometry can be defined, versatilely. Moreover, several advanced specification options are available, e.g. adding a full and partially coating layer. In this use case the available options for configuration are explained and their influence on the geometry of the grating are discussed.

Slanted Grating Medium in Media Catalog



- The build-in slanted grating medium can be found in the embedded media catalog of VirtualLab.
- It can be used in order to set up complex optical grating structures (so-called stacks) and analyzed by applying the Fourier Modal method.

it Slanted Grating Mediu	m X
asic Parameters Scaling	Periodization
Grating Material Name Fused Silica	
Catalog Material State of Matter	Solid V
Groove Material Name Vacuum Catalog Material	Q ✓ ✓ ✓
State of Matter	Gas or Vacuum 🗸 🗸
Fill Factor z-Extension Slant Angle Left	50 % Refers to ● Bottom ○ Top 1 μm 45° ≠ Slant Angle Right 45°
	OK Cancel Help

- The slanted grating medium provides numerous options for customization of the periodic structure.
- First, the material of the grating ridges and of the grooves have to be defined inside the basic parameters tab.
- These materials can either be chosen from the material catalog, or defined by a constant index of refraction.

lit Slanted Grating Medium X
Basic Parameters Scaling Periodization
Grating Material
Name Fused Silica
Catalog Material 🗸 🖉
State of Matter Solid ~
Groove Material
Catalog Material V
State of Matter Gas or Vacuum
Fill Factor 50 % Refers to Top
z-Extension 1 µm
Slant Angle Left 45° ≠ Slant Angle Right 45°
Apply Coating
OK Cancel Help

- Below the material settings, the geometrical parameters of the grating can be defined.
- The following parameters are available:
 - fill factor (defined either at top or bottom of the grating)
 - z-extension (grating height measured along z-direction)
 - slant angle left (slant angle of the left sidewall of the ridge)
 - slant angle right (slant angle of the right sidewall of the ridge)

(in case of equal slant angles, the settings can be linked, by clicking the (un-)equal sign)

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Apply Coating	
	OK Cancel Help
	white the second of the second
Apply Coating	•
Coating Material	
Name Chromium	
Catalog Material	 /
State of Matter Solid	~
Coating Thickness	
	0 m
0 m	0 m
17	
x	
<u> </u>	0 m
Q	OK Cancel Help

- In order to add a configurable coating, the Apply Coating option has to be activated.
- Now, additional options appear along with a sketch of the structure.

Apply (ക്കപ്പപ്പം Coating		
Coating Ma	aterial		
Name C	Chromium		Q
Catalog N	laterial		~ 🥒 旑
St	ate of Matter Solid		~
Coating Tr	0 m		0 m
Q		OK Cance	el Help

- First, the material of the coating has to be selected.
- Again, the material can either be chosen from the material catalog, or defined by a constant index of refraction.
- Next, the thickness of the coating can be configured for each sidewall, top and bottom individually, as depicted in the sketch.

Edit Slanted Grating Medium		×
Basic Parameters Scaling Periodization		
Use Periodization		
Period in x-Direction	1 µm	
Period in y-Direction	+inf m	
Period in z-Direction	+inf m	
Q	OK Cancel Help	

- Due to the slanted grating is defined by a medium, the period has to be set in the periodization tab.
- Because this special medium is designed for gratings, it is always configured to be periodic.

Comment on Usage in Stacks

Edit Stack						;	×
						* de Block	۲
Index	z-Distance	z-Position	Interface	Sub	sequent Medium	Co	m
1	0 m	0 m	Plane Interface			Enter your comme	eni
▶ 2	1 µm	1 µm	Plane Interface		Homogeneous	Enter your comme	en
<						3	>
Validity: Period	0			Add	Insert	Delete	
Stack F	Period is	Dependent f	rom the Period of I	Medium	✓ with Index	к 1 🚖	
Stack F	Period		1 µm				
1	Tools 🎢	•		OK	Cancel	Help	

- For the usage of media within an optical stack it is necessary to define two surfaces which act as boundaries of the medium.
- In general, the distance between these interfaces has to be set manually.
- For the slanted grating medium the height (z-extension) of the medium is directly defined inside the medium configuration.
- Thus, the distance between the surfaces is automatically synchronized with the z-extension of the slanted grating medium.

Sample Configurations of Slanted Grating Medium

Samples of Slanted Grating Medium

- On the next slides some selected examples of the slanted grating media are shown.
- On the left side of each slide the edit dialog is depicted in order to exhibit the related parameters.
- On the right side, the preview of the medium is displayed.
- The preview of the media can be accessed by the preview button at the bottom part of the dialog.

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State of M	atter	Solid	5
Groove Material Name Vacuum			
Catalog Material			)
State of M	latter	Gas or Vacu	ium }
Fill Factor z-Extension Slant Angle Left		50 % 1 μm 45°	Refers to  Bottom
Apply Coating			Ś
Q			ок

it Slanted Grating Medium			
asic Parameters Scaling Periodization		Diagram Table	
Grating Material		Real Part of	Refractive Index
Name Fused Silica	Q		
Catalog Material	<ul> <li>/</li> </ul>		1.4611
State of Matter Solid	~		
Groove Material		_	
Name Vacuum	9		1.2306
Catalog Material	<ul> <li></li></ul>		
State of Matter Gas or Vacuum	~		
Fill Factor 50 % Refer	s to		05 1 1
z-Extension 1 µm		-1 -0.5 0 Ζ [μ	0.5
Slant Angle Left ≠ S	Slant Angle Right 45°	- tr	]
Apply Coating			

Slanted Grating Medium		•	
Basic Parameters Scaling Periodization		Diagram Table	
Grating Material		Real Part	of Refractive Index
Name Fused Silica	Q		
Catalog Material	~ 🖉 📔	•	1.4611
State of Matter Solid	~		
		- 32	
Groove Material			
Name Vacuum	Q		1.2306
Catalog Material	~ 🖉 📔	×	
State of Matter Gas or Vacuum		0.5	
Fill Factor 30 % Refers to  Bottom	Тор		
z-Extension 500 nm		-1 -0.5	0 0.5 1 1
Slant Angle Left 45° ≠ Slant Angle Right	45°	Z	ζ [μm]
Apply Coating			

Slanted Grating Medium		★	
Basic Parameters Scaling Periodization		Diagram Table	
Grating Material		Real Part of Re	fractive Index
Name Fused Silica	Q		
Catalog Material	✓	-	1.4611
State of Matter Solid	~		
Groove Material		-	
Name Vacuum	Q		1.2306
Catalog Material	✓		
State of Matter Gas or Vacuum	$\sim$	-0.5	
Fill Factor 80 % Refers to  Bottom	) Тор	-1 -0.5 0	0.5 1 1
z-Extension 500 nm		Z [µm]	
Slant Angle Left 20° ≠ Slant Angle Right	10°	2 (pm)	
Apply Coating			
OK Cano	cel Help		

Fill Factor 80 % Refers to  Bottom O Top		
z-Extension 500 nm	Diagram Table	
Slant Angle Left 20° ≠ Slant Angle Right 10°	Real Part of Refractive Index	
Apply Coating Coating Material Name Chromium Catalog Material State of Matter Solid Coating Thickness 20 nm 0 m 0 m 0 m 0 m	S O S O S O S O S O S O S O S O S O S O	2.8641 1.932
OK Cancel Help		

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document code	MISC.0058
version	2.0
toolbox(es)	Grating Toolbox
VL version used for simulations	7.4.0.49
category	Feature Use Case
further reading	<ul> <li>Analysis of Slanted Gratings for Lightguide Coupling</li> <li>Parametric Optimization and Tolerance Analysis of Slanted Gratings</li> <li>Configuration of Grating Structures by Using Special Media</li> </ul>