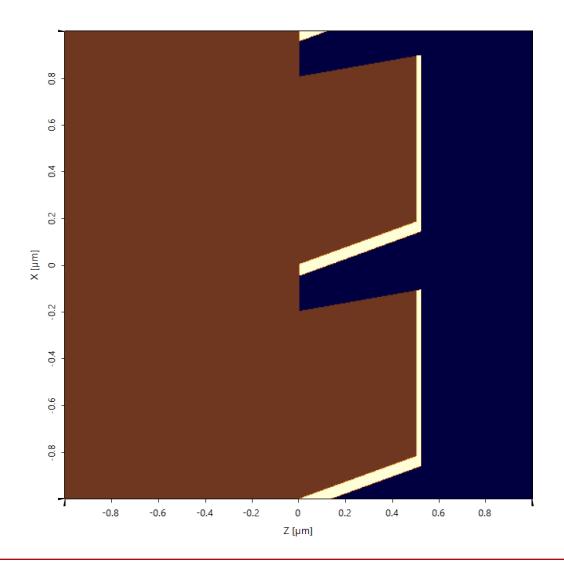


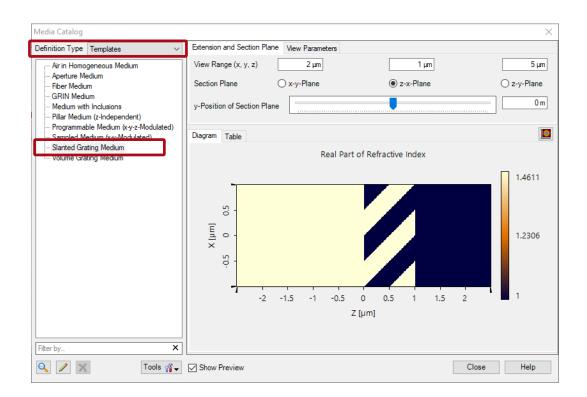
Advanced Configuration of Slanted Gratings

Abstract



VirtualLab Fusion 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 a 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 Fusion.
- It can be used in order to set up complex optical grating structures (so-called stacks) and analyzed by applying the Fourier Modal method.

lit Slanted Grating Medium	x X
Basic Parameters Scaling	Periodization
Grating Material Name Fused Silica	
Catalog Material State of Matter	Solid V
Groove Material Name Vacuum Catalog Material	
State of Matter	Gas or Vacuum
Fill Factor	50 % Refers to
Slant Angle Left	45° ≠ Slant Angle Right 45°
Q	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.

Edit Slanted Grating Medium X
Basic Parameters Scaling Periodization
Grating Material
Name Fused Silica
Catalog Material 🗸 🖉
State of Matter Solid ~
Groove Material
Name Vacuum
Catalog Material 🗸 🖉
State of Matter Gas or Vacuum 🗸
Fill Factor 50 % Refers to O Bottom O 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)

Apply Coating	
	OK Cancel Help
Apply Coating	•
Coating Material	
Name Chromium	Q
Catalog Material	 /
State of Matter Solid	\sim
Coating Thickness	
	0 m
0 m	0 m
tz //	
	0 m
	<u> </u>
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 Coating	
Coating Material	
Name Chromium	Q
Catalog Material	 Image: A start of the start of
State of Matter	Solid 🗸
Coating Thickness	
9	OK Cancel 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								×
Index z-Di	stance	z-Position	Interface	5	Subseque	nt Medium		Com
1 0) m	0 m	Plane Interface				Enter y	our comment
▶ 2 1	μm	1 µm	Plane Interface		_	ogeneous Q	Enter y	our commen
<								>
Validity: 🕑 Period				Add		Insert	[Delete
Stack Period		Dependent f	rom the Period of	Medium	~	with Index	1	-
Stack Period			1 µm					
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- 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	<u>ک</u>
Groove Material Name Vacuum			
Catalog Material			100 m
State of M	latter	Gas or Vacu	ium }
Fill Factor		50 %	Refers to  Bottom
z-Extension		1 µm	
Slant Angle Left		45°	≠ Slant Angle Righ
Apply Coating			}
<b>Q</b>			ок

t Slanted Grating Medium			
Basic Parameters Scaling Periodization		Diagram Table	
Grating Material			Part of Refractive Index
Name Fused Silica	Q		_
Catalog Material	~ 🥒 📔	<b>-</b>	1.4611
State of Matter Solid	~		
		5	
Groove Material			
Name Vacuum	Q		1.2306
Catalog Material	<ul> <li>Image: Image: Ima</li></ul>	×	
State of Matter Gas or Vacuum	$\sim$	05	
Fill Factor 50 % Refers to   Bottom	⊖ Тор		
z-Extension 1 µm		-1 -0.5	0 0.5 1 1
Slant Angle Left 45° ≠ Slant Angle Right	45°		Ζ [μm]
Apply Coating			

it Slanted Grating Medium	★	
asic Parameters Scaling Periodization	Diagram Table	
Grating Material	Real Part of Refr	active Index
Name Fused Silica		
Catalog Material V		1.4611
State of Matter Solid ~		
	- 0.5	
Groove Material	-	
Name Vacuum		1.2306
Catalog Material V 🖉	*	
State of Matter Gas or Vacuum 🗸	0.5	
Fill Factor 30 % Refers to  Bottom O Top		05 1 1
z-Extension 500 nm	-1 -0.5 0	0.5 1 🔳 1
Slant Angle Left     45°     ≠     Slant Angle Right     45°	Ζ [μm]	
Apply Coating		
OK Cancel Help		

Slanted Grating Medium	•	
sic Parameters Scaling Periodization	Diagram Table	
Grating Material	Real Part of Refr	active Index
Name Fused Silica		_
Catalog Material V 🖉 📔	-	1.4611
State of Matter Solid ~		
	5: -	
Groove Material		
Name Vacuum		1.2306
Catalog Material 🗸 🆉	×	
State of Matter Gas or Vacuum		
Fill Factor 80 % Refers to  Bottom O Top		
z-Extension 500 nm	-1 -0.5 0	0.5 1 1
Slant Angle Left 20° ≠ Slant Angle Right 10°	Ζ [µm]	
Apply Coating		
OK Cancel 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 Refractiv	
Apply Coating Coating Material Name Chromium Catalog Material State of Matter Solid Coating Thickness 20 nm 0 m 0 m	SO 0 5O -1 -0.5 0 0. Z [μm]	2.8641 1.932 5 1 1
OK Cancel Help		

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document code	MISC.0058
version	2.0
toolbox(es)	Grating Toolbox
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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>