

Specification of Diffraction Efficiencies for Grating Regions

Abstract



In modern optical systems, gratings are no longer just components in their own right: they also often appear etched into or deposited onto the surface of other elements. When this is the case, they may cover only part of that surface. This is what we call a "grating region". When simulating a system which contains such a component in VirtualLab Fusion, the user can choose between modeling the grating rigorously or inputting the values of the efficiencies ad hoc when the behaviour of the grating is known, or a good guess is available. Both procedures are illustrated here.

Modeling Task



System Construction

- Initialization
 - Pre-define a grating region on a single plane interface.



Diffraction Efficiency Settings

- Grating definition
 - Define an ideal linear grating with period of 1µm.
 - By default, the overall transmission-reflection efficiency is preset at 80-20%, and they are uniformly distributed over all propagating orders.



overall transmission-reflection efficiency, or type in the values.

Field Tracing Simulation

- Grating definition
 - Define an ideal linear grating with period of 1µm.
 - By default, the overall transmission-reflection efficiency is preset at 80-20%, and they are uniformly distributed over all propagating orders.
 - Run field tracing simulation.

dit Grating Region X	:
Shape Region Channels Grating	
Order Selection Efficiencies	
Use Ideal Gratings O Use Real Gratings	
Grating Vector 6.28E+06 1/m × 0 1/m Calculator 1D Gratings	
Overall Transmission 80 % Overall Reflection 20 %	
From Front Side	
Direction Order Number Efficiency Direction Order Number Efficiency	



Diffraction Efficiency Settings

- Grating definition
 - To define certain orders with given efficiencies, one must specify these orders first under the Order Selection tab.
 - Then define the efficiency for the specified diffraction orders, e.g., T-1=75% and R+1=19%, under the *Efficiencies* tab.

dit Grating Region			×
Shape Region Channels Grating			
Order Selection Efficiencies			
Propagating Orders All Orders	~		
From Front Side		From Back Side	
Direction Order Number T -1 R +1		Direction Order Number	
Edit Grating Region			×
Shape Region Channels Grating			
Order Selection Efficiencies			
Use Ideal Gratings		O Use Real Gratings	
Grating Vector	6.28E+06 1/m ×	0 1/m	Calculator 1D Gratings
Overall Transmission	80 %	Overall Reflec	ction 20 %
From Front Side		From Back Side	
Direction Order Number Eff T -1 R +1	iciency 75 % 19 %	Direction Order Number	Efficiency
Validity: 🕑		ОК	Cancel Help

Field Tracing Simulation

- Grating definition
 - To define certain orders with given efficiencies, one must specify these orders first under the Order Selection tab.
 - Then define the efficiency for the specified diffraction orders, e.g., T-1=75% and R+1=19%, under the *Efficiencies* tab.
 - Run field tracing simulation.





Grating Settings

- Grating definition
 - Next we Use Real Gratings instead of ideal ones.
 - VirtualLab can calculate automatically the real grating period according to the ideal grating vector.
 - To keep the grating period as defined ideally, we choose Yes in the pop-up window.

Edit Grating Region		×
Shape Region Channels	3 Grating	
Order Selection Efficien	ncies	
Use Ideal Grating	IS Use Real Gratings	
Grating Vector	6.28E+06 1/m × 0 1/m Calculator 1D Gratin	igs
Overall Transmissio	n 80 % Overall Reflection	20 %
From Front Side	From Back Side	
Direction Order T R	Number Efficiency Image: Number of the second sec	
Validity: 🕑	Period Conversion X H	elp
	? Calculate stack period and orientation from grating vector?	
	Yes No	

Grating Settings

- Grating definition
 - Set up the default
 Sawtooth Grating with 1µm modulation depth (check Grating Toolbox for more info).

Edit Grating Regi	on					>	<
Shape Region	Channels G	àrating					
Order Selection	Efficiencies	•					
🔿 Use Idea	l Gratings			۲	Use Rea	al Gratings	
Grating Stac Sawtooth C Orientation	k àrating (Rotation ab	out z-Axis)		0°		Coad Citew Citew Coat Inc.	
Settings for Number of Decomposi	Generation of Evanescent (tion Settings	Lookup Table Drders	Configure	10 🜩			
Lookup Tab No lookup t	le able set		[Save		× Remove	
Validity: 🚹						OK Cancel Help	



Grating Settings

- Grating definition
 - Set up the default
 Sawtooth Grating with 1µm modulation depth (check Grating Toolbox for more info).
 - Following the same way, we also set up a Sinusoidal Grating with the same period and modulation depth, for comparison.

Edit Grating Region		X
Shape Region Channels Grating		
Order Selection Efficiencies		
O Use Ideal Gratings	Use Real Gratings	
Grating Stack		
Sinusoidal Grating	🚰 Load 📝 Edit 🔍 View	
Orientation (Rotation about z-Axis)	0° Rotation about y-Axis by 180°	
Settings for Generation of Lookup Tab	le	
Number of Evanescent Orders	10 🗧	
Decomposition Settings	Configure	
Lookup Table		
No lookup table set		
🚰 Load	Save Kemove	
Validity: 🚹 🚺	OK Cancel Help	



Field Tracing Simulation

- Grating simulation
 - Run field tracing simulation for both the sawtooth and the sinusoidal gratings.



Sawtooth grating shows asymmetry in diffraction efficiencies



Sinusoidal grating provides symmetric efficiencies around zeroth order

Document Information

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