Scenario 246.01: Rigorous Simulation of Light Diffraction at Coated Sinusoidal Grating

This example demonstrates the rigorous simulation of a coated sinusoidal grating and it illustrates the effect of the coating on the summed efficiency of all reflected orders.

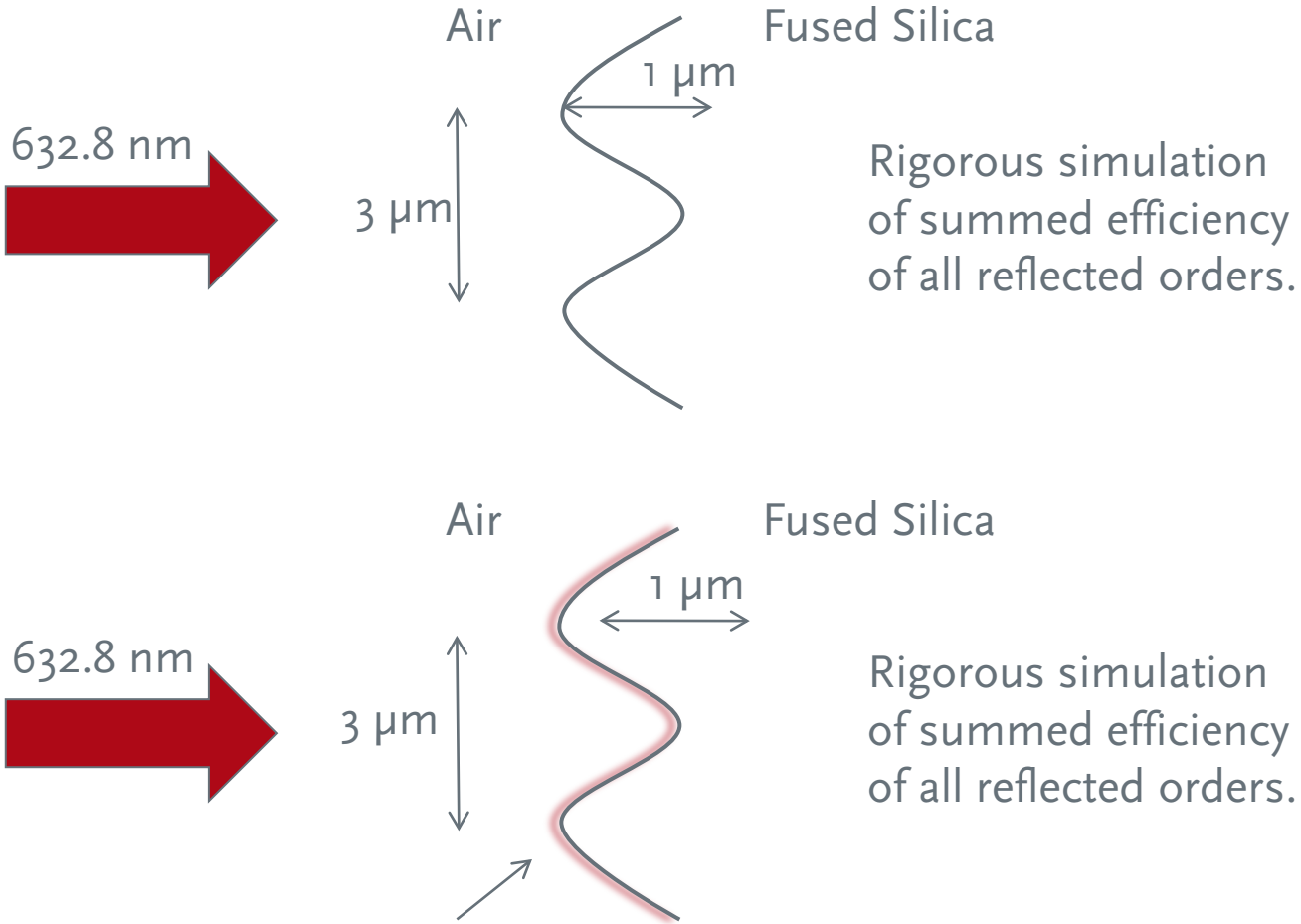
Keywords: rigorous analysis, FMM, sinusoidal grating, coating

Required Toolboxes: Grating Toolbox

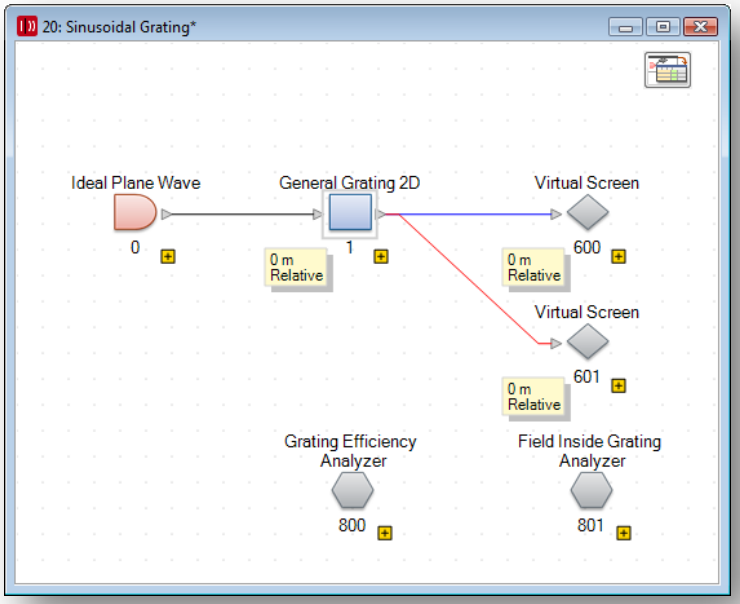
Related Scenarios: G.001a, Scenario 104.01

LightTrans

Modeling Task

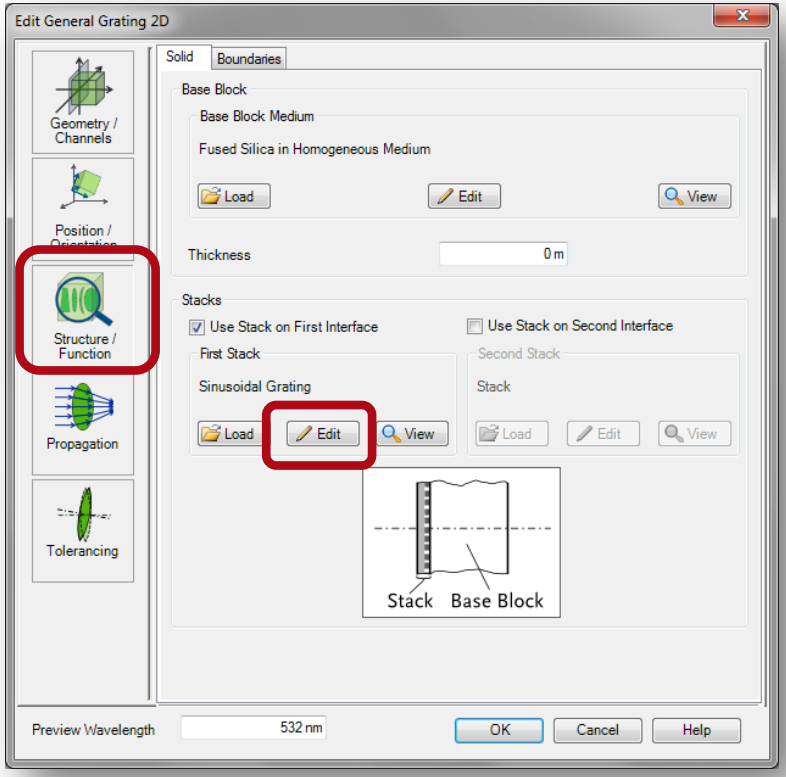


Modeling of Coating on Surface Grating



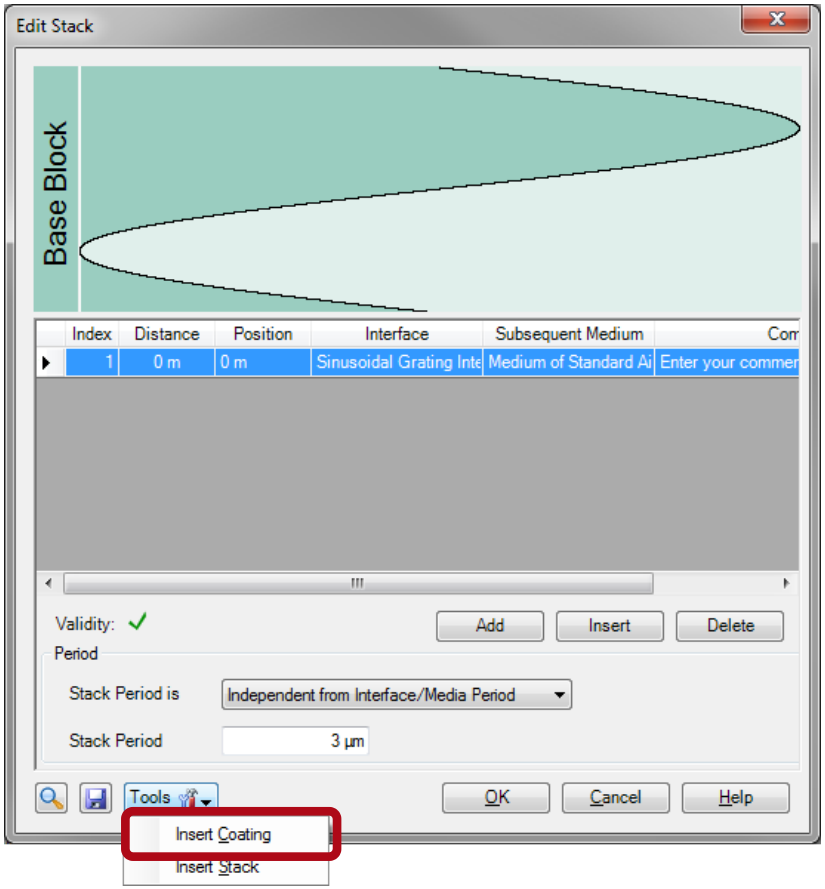
- Load sample file 'Scenario_246.01_ Sinusoidal_Grating_ without_Coating.lpd'
- This sample file contains a sinusoidal grating.
- Use *Grating Efficiency Analyzer* to analyze the grating.

Modeling of Coating on Surface Grating



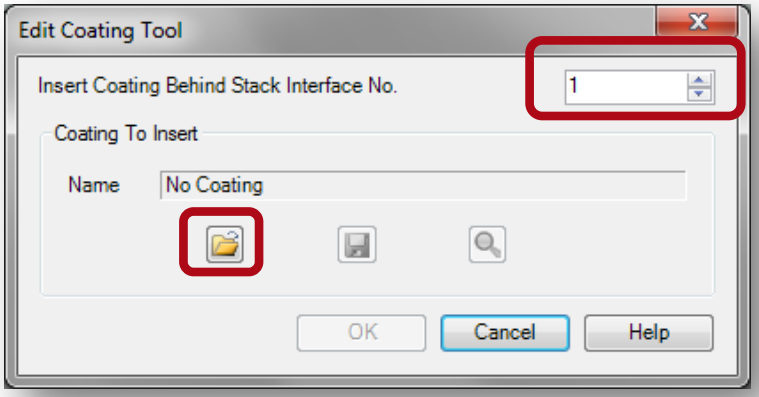
- To add a coating to the grating double click on *General 2D Grating* component to open *Edit* dialog.
- Select *Structure / Function* page.
- Click *Edit* button of first stack to display the stack editor dialog.

Modeling of Coating on Surface Grating



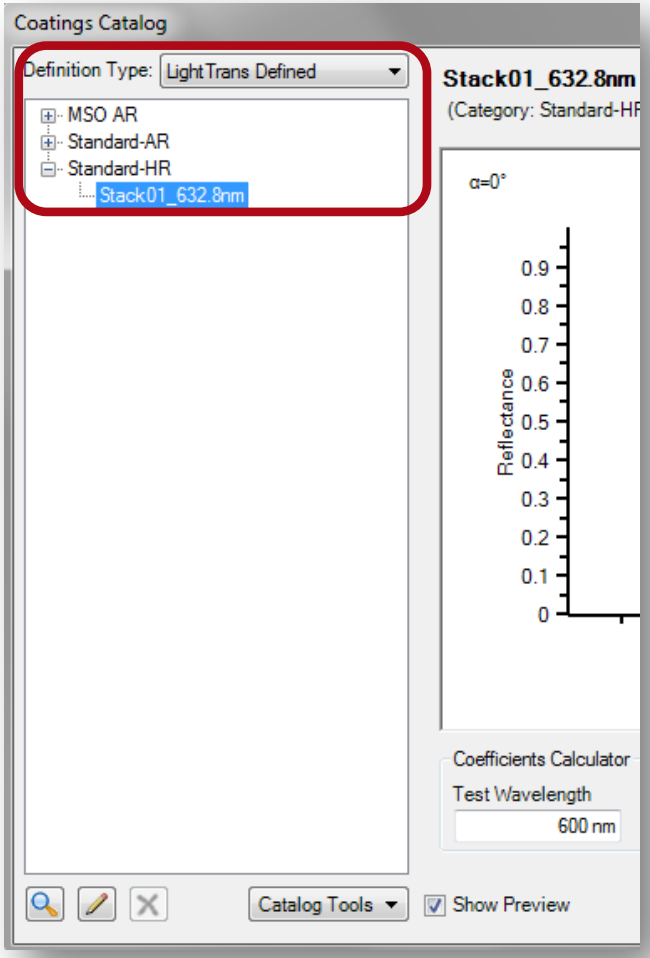
- In order to take a coating during the rigorous simulation into account the coating must be inserted to the stack as a sequence of surfaces and media.
- Click on *Stack Tools*.
- Select *Insert Coating*.

Modeling of Coating on Surface Grating



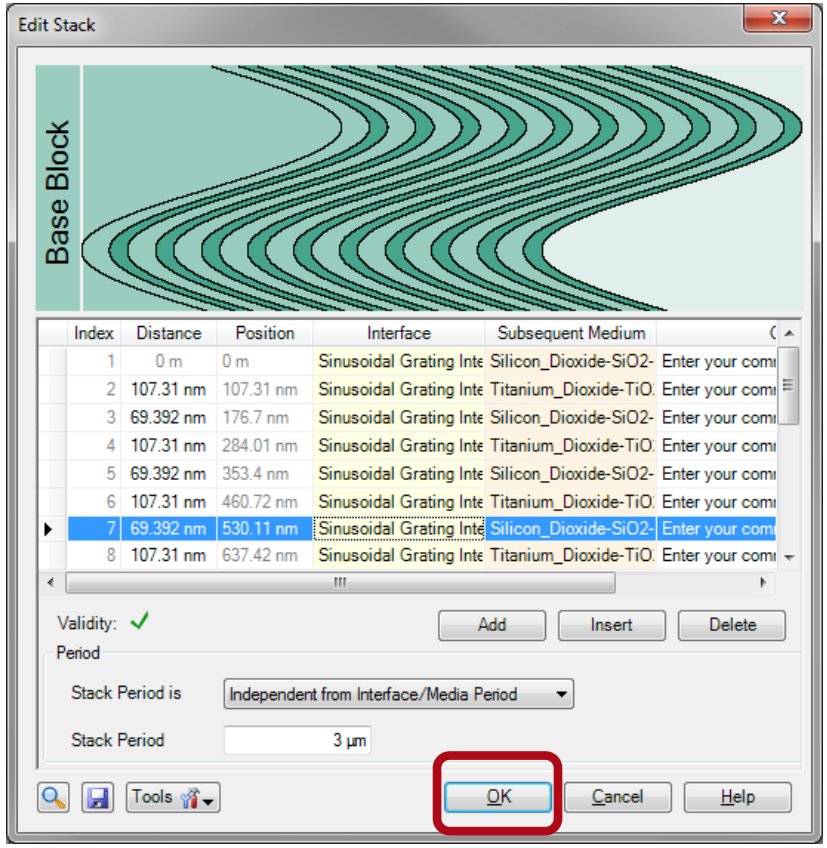
- Select optical interface no. 1 in order to add on this surface a coating.
- Click the -button to load a coating from the coating catalog.

Modeling of Coating on Surface Grating



- Select the *LightTrans Defined* catalogs and choose the *Standard-HR* catalog.
- Click on *Stack01_632.8nm*.
- Click the *OK* button of the catalog dialog and the *OK* button of the *Edit Coating Tool* dialog.

Modeling of Coating on Surface Grating



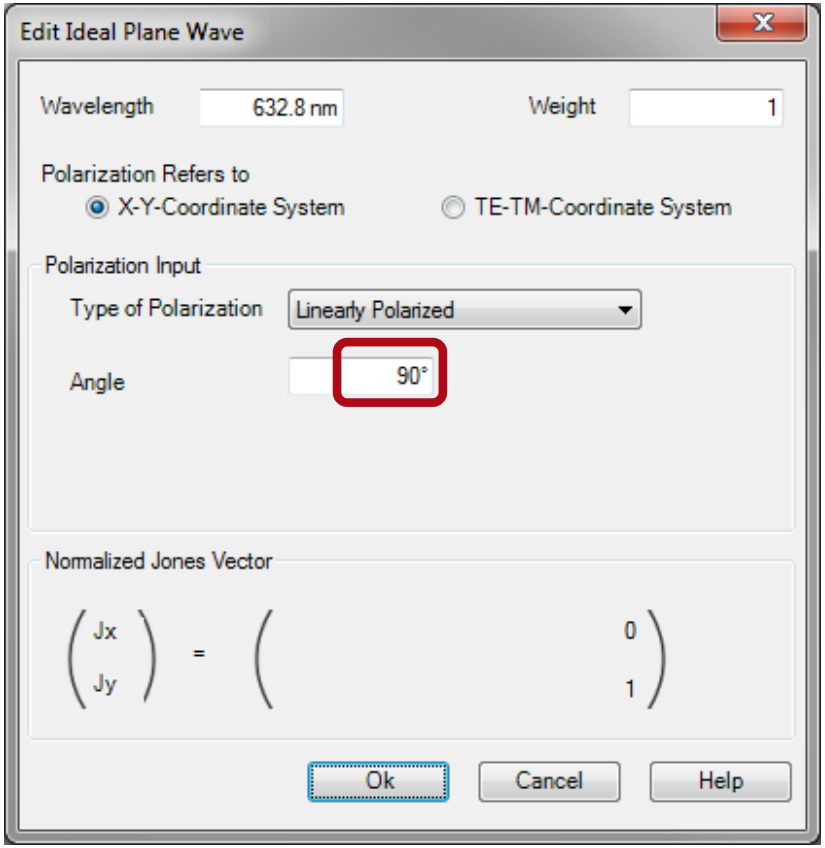
- Now the stack editor contains the coating on top of the surface as a sequence of surfaces and media.
- Click *OK* to close the stack editor.
- Close the component dialog by clicking the *OK* button.
- Use *Grating Efficiency Analyzer* to analyze grating.

Simulation Results for x-Polarization

Detector	Sub - Detector	Result
Without coating Grating Efficiency Analyzer	Overall Transmission Efficiency	98.996 %
	Overall Reflection Efficiency	1.0035 %
	Overall Reflection and Transmission Efficiency	100 %
	Absorption	0 %
With coating Grating Efficiency Analyzer	Overall Transmission Efficiency	57.147 %
	Overall Reflection Efficiency	42.853 %
	Overall Reflection and Transmission Efficiency	100 %
	Absorption	7.7716E-14 %

- The results can be found in the Detector Results section of the main window.
- The high reflection coating increases the reflection significantly.

Changing the Polarization



- In the edit dialog of the *Ideal Plane Wave* light source you can change the polarization to pure y-polarization.
- Two preset sample files (without and with coating) are provided for y-polarization.

Simulation Results for y-Polarization

Detector	Sub - Detector	Result
Without coating Grating Efficiency Analyzer	Overall Transmission Efficiency	97.607 %
	Overall Reflection Efficiency	2.3927 %
	Overall Reflection and Transmission Efficiency	100 %
	Absorption	3.4417E-13 %
With coating Grating Efficiency Analyzer	Overall Transmission Efficiency	48.85 %
	Overall Reflection Efficiency	51.15 %
	Overall Reflection and Transmission Efficiency	100 %
	Absorption	1.5543E-13 %

- Also for y-polarization, the high reflection coating increases the reflection significantly.

Conclusion

- The rigorous simulation of coated gratings requires to specify the coating layers as a sequence of surfaces.
- The Grating Toolbox allows to take into account the effect of coatings and to use coatings of the VirtualLab™ coating catalog.
- VirtualLab™ can take into account the reduction of the layer thickness depending on the normal vector as it often appears during the fabrication process.