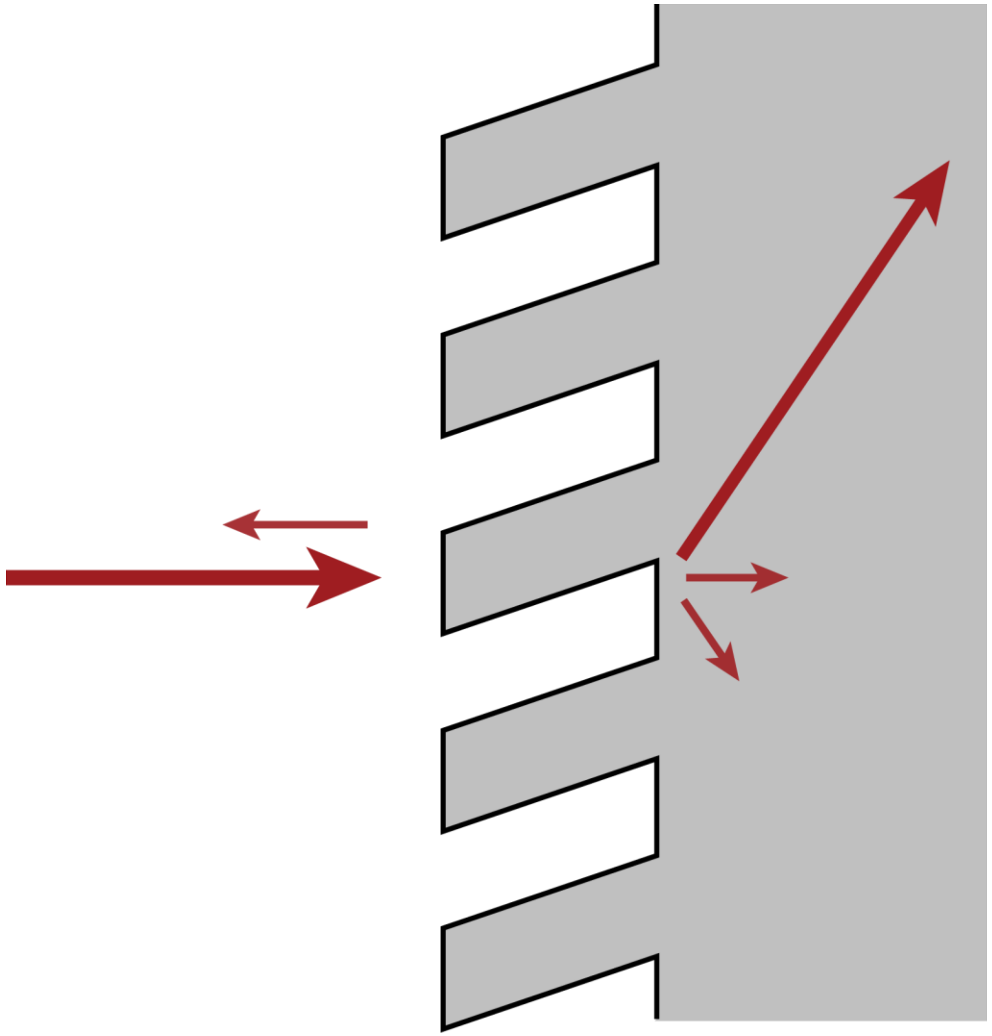
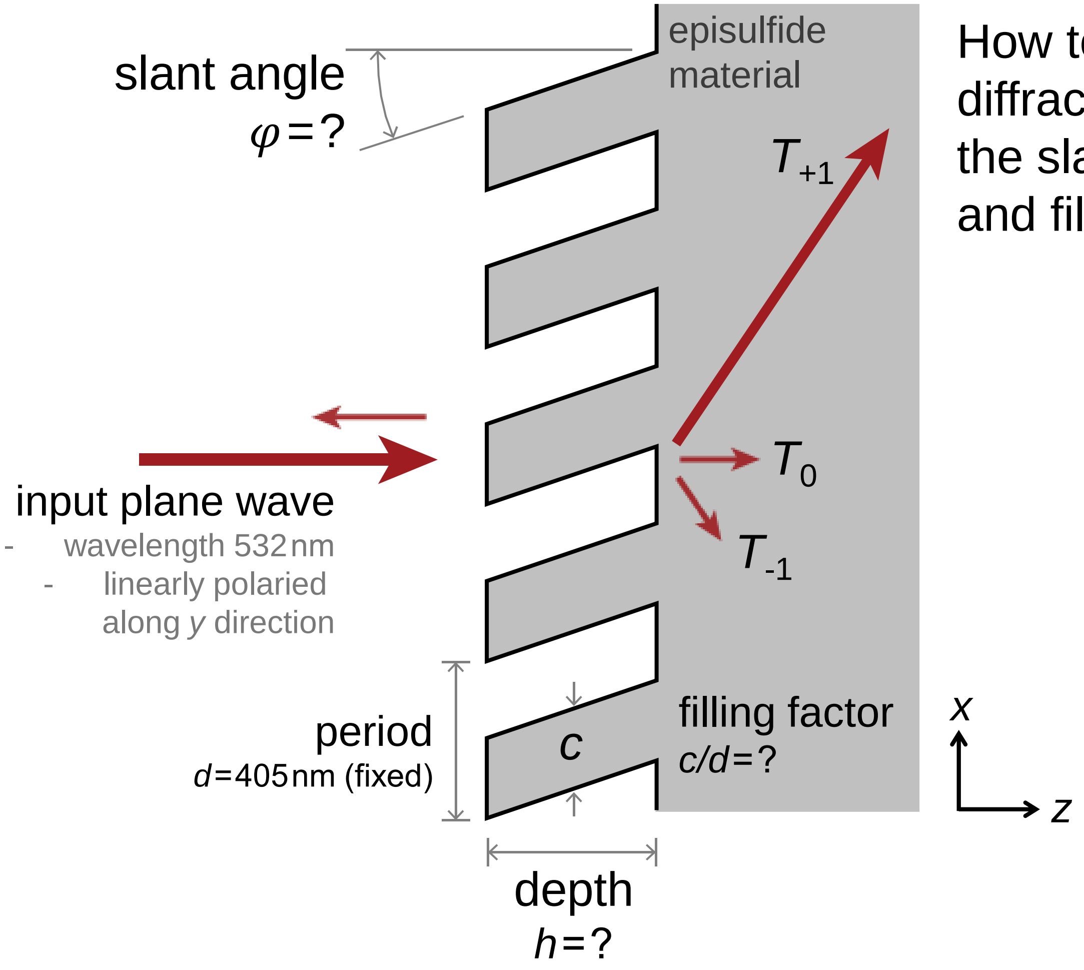
Parametric Optimization and Tolerance Analysis of Slanted Gratings

Abstract

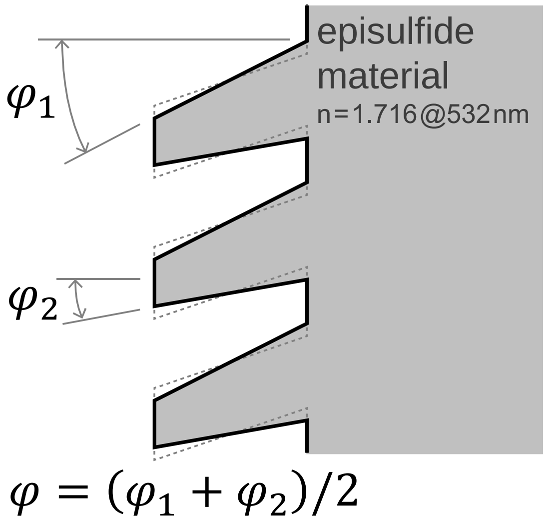


Coupling of light into guiding structures with high efficiency is an important issue for many applications, like backlight, optical interconnector, and near-to-eye displays. For such applications, slanted gratings are well known for being capable to couple monochromatic light with high efficiency. In this example, the optimization of a slanted grating with the rigorous Fourier modal method is presented. The optimized grating shows a diffraction efficiency of over 90% for a predefined direction order. In addition, the influence from the slope deviation of the grating is investigated.

Modeling Task

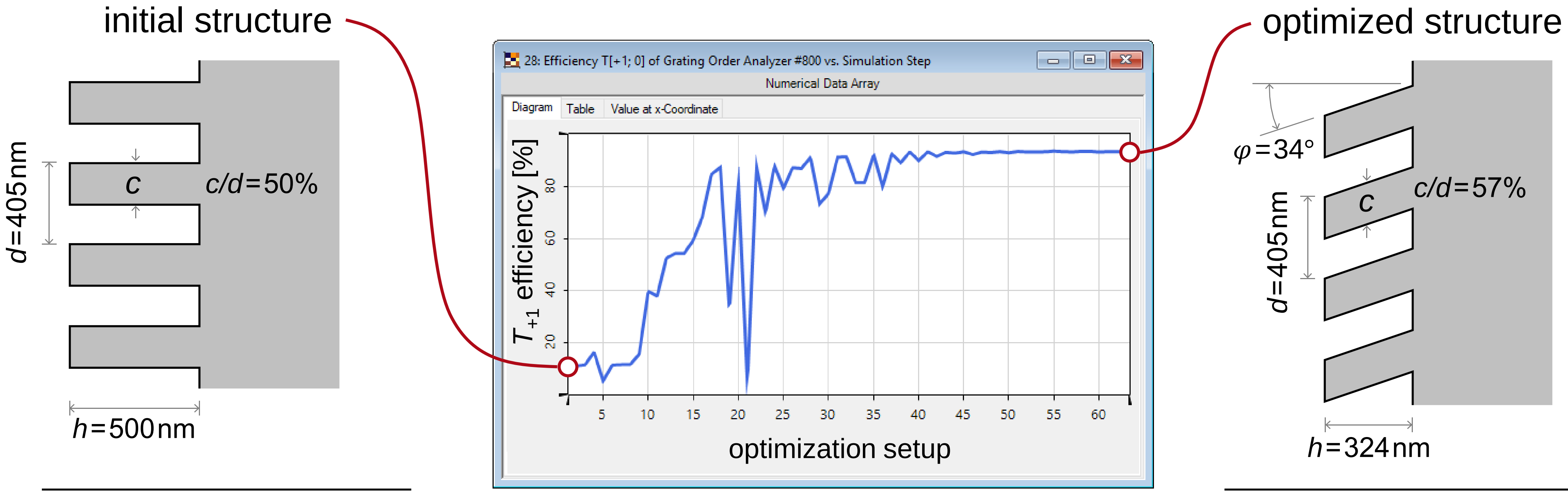


How to optimize the T_{+1} order diffraction efficiency, by adjusting the slant angle φ, grating depth h, and filling factor c/d?



In addition, how to evaluate the grating performance with the slope deviation due to the fabrication technique taken into account?

Results – Parametric Optimization



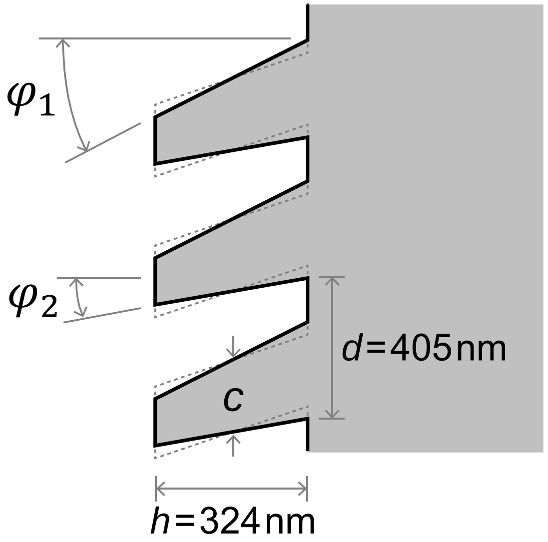
Order	Efficiency
-1	11.551%
0	72.795%
+1	11.551%

parametric optimization with rigorous Fourier modal method for grating efficiency calculation

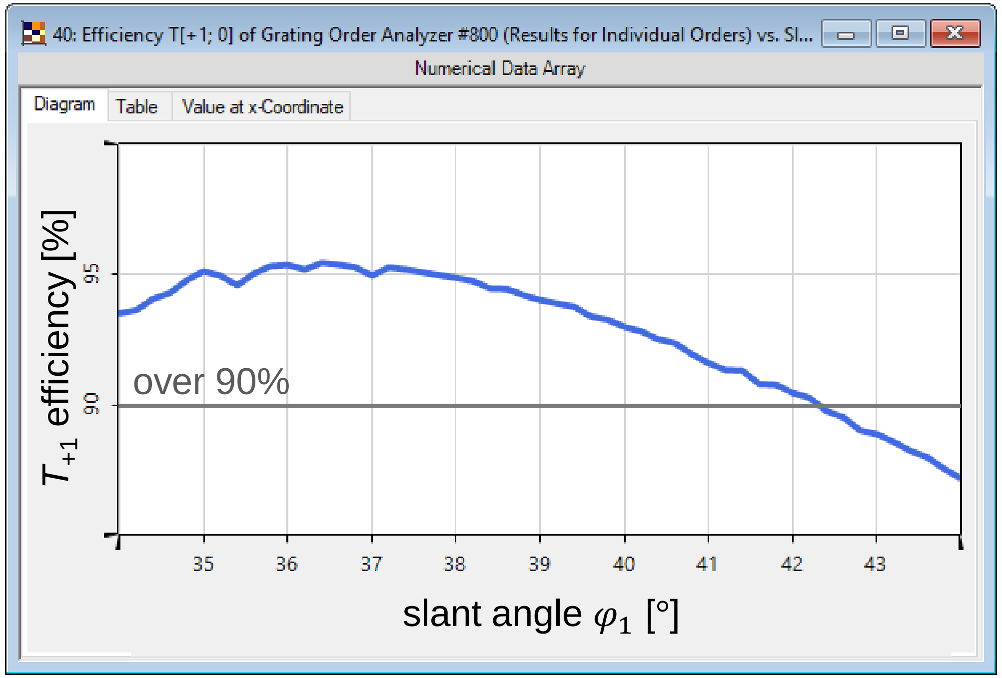
Order	Efficiency
-1	3.257%
0	0.365%
+1	**93.659%**

Results – Tolerance Analysis

The fabricated slanted gratings often shows a deviation from the perfect parallel grating lines. Such slope deviations should be taken into account for the tolerance analysis.



- fixed average slant angle $\varphi = (\varphi_1 + \varphi_2)/2 = 34°$
- fixed filling factor c/d=57%
- varying φ_1 from 34 to 44°



Rigorous simulation with Fourier modal method, for tolerance analysis over 50 steps, takes 30 seconds.

Document Information

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