Beam steering with a LCOS-SLM

1. Simulation of a blazed phase stepped grating with a number N of equidistant phase steps for two cases: without quantization & 2𝜋 phase modulation.
2. Meaning of the used parameters: M = maximum phase depth, alpha = diffraction order, N = phase steps, lamda = wavelength, pixel\_pitch = pixel pitch of the SLM.
3. Exported parameters: diff\_eff: diffraction efficiency, the use of 0th denotes zeroth diffraction order

First Case: Without Quantization (continuous phase grating)

clear all; clc

iter = 0;

for M = 0:6

iter = iter + 1;

alpha\_0th = 0;

diff\_eff\_0th(iter) = sinc(M-alpha\_0th)^2;

alpha\_1th = 1;

diff\_eff\_1th(iter) = sinc(M-alpha\_1th)^2;

alpha\_2th = 2;

diff\_eff\_2th(iter) = sinc(M-alpha\_2th)^2;

alpha\_3th = 3;

diff\_eff\_3th(iter) = sinc(M-alpha\_3th)^2;

alpha\_4th = 4;

diff\_eff\_4th(iter) = sinc(M-alpha\_4th)^2;

end

M=0:6;

figure; plot(M,diff\_eff\_0th,'LineWidth',2)

hold on

plot(M,diff\_eff\_1th,'LineWidth',2)

plot(M,diff\_eff\_2th,'LineWidth',2)

plot(M,diff\_eff\_3th,'LineWidth',2)

plot(M,diff\_eff\_4th,'LineWidth',2)

hold off

xlabel ('Maximum Phase Depth (M)','Interpreter','latex');ylabel ('Normalized Diffraction Efficiency','Interpreter','latex');

set(gca,'Linewidth',2);set(gca,'TickLabelInterpreter','latex');set(gca,'TickLength',[0, 0]);set(gca,'LooseInset',max(get(gca,'TightInset'), 0.02))

ax=gca;ax.FontSize=14;pos=get(gca,'pos');set(gca,'pos',[pos(1) pos(2) pos(3) pos(4)\*.95]);

%print('without\_quantization','-dsvg','-r600') % save high-quality figure

Second Case: 2π phase modulation (M=1)

clear all; clc

iter = 0;

for N = 0:20

iter = iter + 1;

diff\_eff(iter) = sinc(1/N)^2;

end

N=0:20;

figure; plot(N,diff\_eff,'LineWidth',2)

xlabel ('Phase Quantization Levels (N)','Interpreter','latex');ylabel ('Normalized Diffraction Efficiency','Interpreter','latex');

set(gca,'Linewidth',2);set(gca,'TickLabelInterpreter','latex');set(gca,'TickLength',[0, 0]);set(gca,'LooseInset',max(get(gca,'TightInset'), 0.02))

ax=gca;ax.FontSize=14;pos=get(gca,'pos');set(gca,'pos',[pos(1) pos(2) pos(3) pos(4)\*.95]);

%print('phaseModulation','-dsvg','-r600') % save high-quality figure

Bonus Case: Study of steering angle of a given blazed grating

clear all; clc

alpha = ; lamda = ; pixel\_pitch = 6.4e-6; N =;

steering\_angle = asin (alpha\*lamda/N\*pixel\_pitch)

Critical paper for understanding the code:

### Moreno, I. *et al.* Diffraction efficiency of stepped gratings using high phase-modulation spatial light modulators. *Optics and Lasers in Engineering* **126**, 105910 (2020).

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