Contents

Evaluate radiometric consistency of simulations with microlith.

Compare images of a point, pairs of points, and a 1D grating with varying degrees of coherence to check that relative intensities scale with the numerical aperture of illumination and the specimen transmission.

Image of a point generated by microlith has unity peak amplitude when imaged with a brightfield microscope having circular aperture imaging and illumination apertures of 1 and the pixel-size of 100nm.

Define the simulation grid and parameters of imaging system.

```
L=8; % Support over which we want to calculate the image.

xs=0.05; % Sampling rate in the specimen plane.
% To avoid aliasing, specimen should be sampled at 0.2 lambda/NA
% atleast.
% Sampling rate in the specimen plane determines extent in frequency
% domain.  xs=0.1 should suffice as the transfer function fits into the square with
% side 2 or (1+S)/sqrt(2) and sampling at 0.1 defines support of [-5 5].

v=-L:xs:L; % Transeverse extent of simulation.
u=0; % Analytical expression for two point image is available only in focus.

params.NAo=1;
params.lambda=1;
params.nImm=1;
params.nEmbb=1;
[xx, yy]=meshgrid(v);
twopoint=(abs(abs(xx)-0.3)<10*eps ...
        & abs(yy)<10*eps );
point=(abs(xx)< 10*eps & abs(yy)< 10*eps);
grating=0.5*(1+cos(2*pi*xx));
grating=grating.*double(abs(xx)<=4 & abs(yy)<=4);
% Limit the size of grating to avoid edge-artifacts.

NAc=[0 0.5 1];
pointImg=zeros([size(point) length(NAc)]);
twopointImg=zeros([size(point) length(NAc)]);
gratingImg=zeros([size(point) length(NAc)]);

% Instantiate the microscope.
brightfield=microlith(v,u);
```

Compute images.

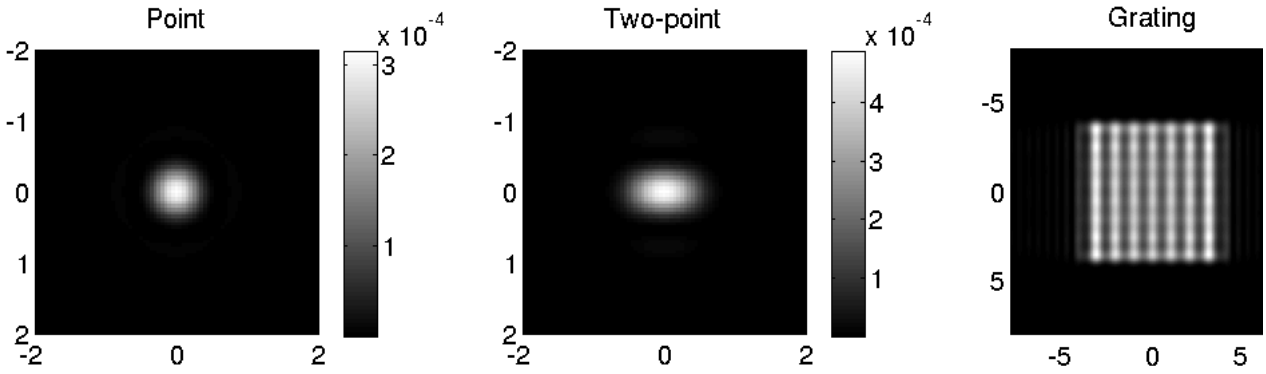
```
for idx=1:numel(NAc)
    params.NAc=NAc(idx);
    computesys(brightfield,'Brightfield',params);
    pointImg(:,:,idx)=computeimage(brightfield,point,'CPU');
    twopointImg(:,:,idx)=computeimage(brightfield,twopoint,'CPU');
    gratingImg(:,:,idx)=computeimage(brightfield,grating,'CPU');
end
```

Compare the images.

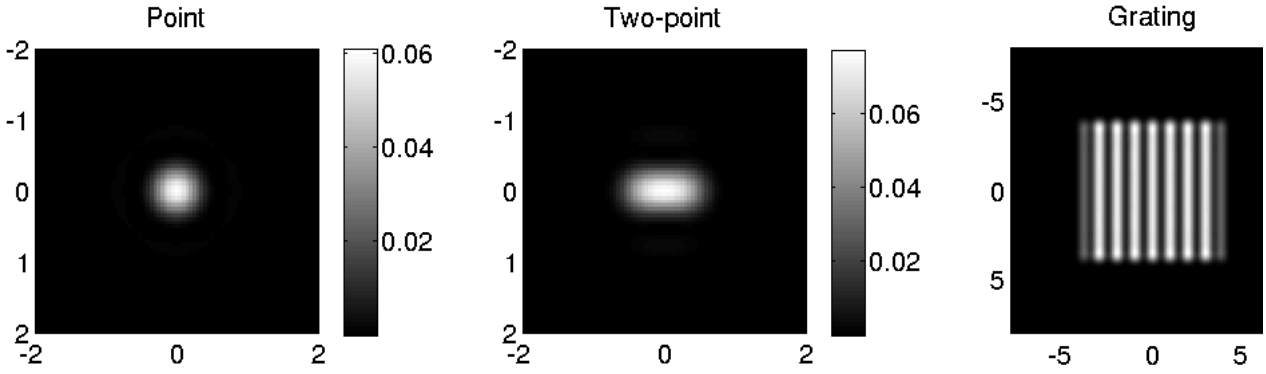
```
figure(1); colormap gray;
set(1,'Color','white','Position',[100 100 1300 400],'defaultaxesfontsize',16);

for idx=1:numel(NAc)
    clf;
    subplot(131);
    imagesc(v,v,pointImg(:,:,idx)); axis equal; colorbar; title('Point');
    xlim([-2 2]); ylim([-2 2]);
    subplot(132);
    imagesc(v,v,twopointImg(:,:,idx)); axis equal; colorbar; title('Two-point');
    xlim([-2 2]); ylim([-2 2]);
    subplot(133);
    imagesc(v,v,gratingImg(:,:,idx)); axis equal; colorbar; title('Grating');
    axis tight;
    RadiometricFactor=params.NAo^2*NAc(idx)^2*(xs/0.1)^2;

    annotation('textbox',[0.1 0.9 0.8 0.1],'String',...
    ['NA_c=' num2str(NAc(idx)) ', xs=' num2str(xs) ', Radiometric Factor=' num2str(RadiometricFactor) ],'FontSize',16,'Edgecolor','none');
```

```
pause(1);
snapnow;
end
```

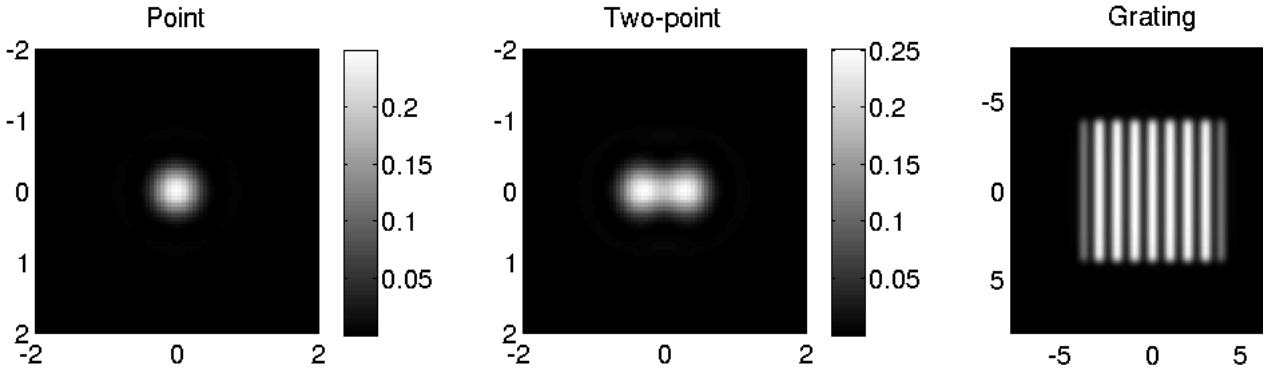
NA_c=0, xs=0.05, Radiometric Factor=0



NA_c=0.5, xs=0.05, Radiometric Factor=0.0625



NA_c=1, xs=0.05, Radiometric Factor=0.25



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