Digital Image Processing – HW1

Submitters:  
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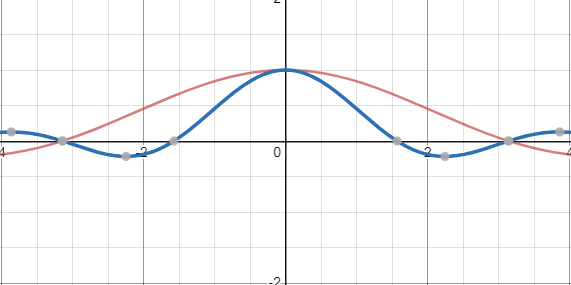
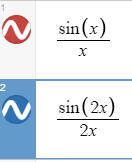
1. Theoretical questions
2. Let be the image that would be formed on the image plane if the camera was still, and be the actual formed digital image of the k-th frame.  
   In the process of taking the actual image we imply 2 actions – Sampling(digitalizing) and translation(due to the handshakes).  
   Mathematically, the convolution kernel describing the above actions would be:

1. The Fourier transform of is given by:
2. Let be the spectral decomposition of the real-world image.  
    – Real-world image (calculated via the pixel’s cumulative sunlight absorption).  
    – Photographer’s handshakes.  
    – Camera shutter exposure time describing function.  
     
   Mathematically:

The expression for the frequency response of the discrete kernel .

1. We’ll express with respect to the given trajectory:

This concludes an expected outcome:  
The higher the velocity –> sinc is more narrow This lead to a more concentrated spectrum -> Blurrier images( Which is the main idea of this task 😊 )



1. We’ll generalize the previous result for :

We can see that now the sinc’s directions are based on the velocity directions + higher velocity will result a more concentrated spectrum, just like before.  
The added function, results the same effect of concentrating the spectrum the higher the velocity gets.