

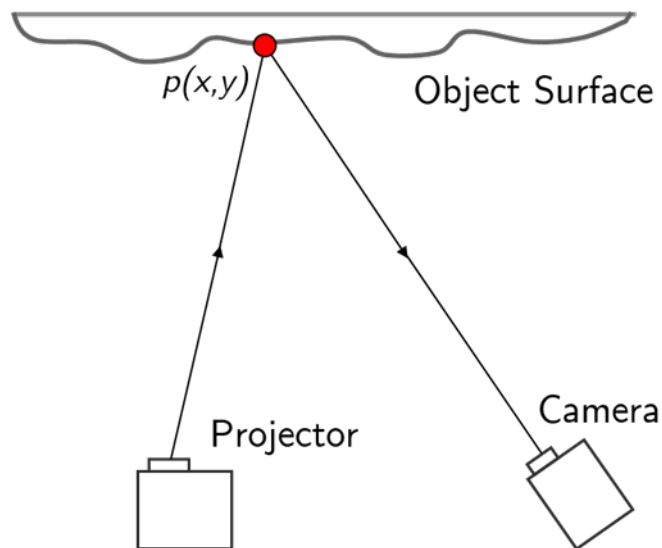
## Activity 13 – Shape from Structured Illumination : Phase Shift Profilometry

### Materials:

Projector, white matte-3d object, flat white foam board, PiCam, tripod

### Procedure:

1. Prepare 4 (four) 2-D sinusoid grayscale images of the form  $M(1+\cos(X+\theta))$  where  $\theta=0,\pi/2,\pi,3\pi/2$  and M is a constant. Project on a flat white foam board using a projector and ensure that the image size maximizes the full pixel resolution of the projector that will be used. Set M such that it will limit the maximum and minimum grayscale value of the sinusoid to between 20 and 120. Adjust this range if the image appears too bright or dark or else adjust the exposure of the camera. Make sure you get the raw values of the camera to avoid nonlinearities in the acquired image. If the raw format cannot be accessed in your camera limit the sinusoid grayscale along the linear range of the camera sensitivity.
2. With camera fixed on a tripod and a flat white foam board as reference object, set up the camera-projector-object as shown in the image below. Capture an image of the form board for each projected sinusoid.



3. Next, replace the reference foam board with your white 3D object and capture an image again for each of the four shifted sinusoids.
4. Calculate and unwrap the phase for both reference and test object. Get their difference and display the phase difference as a 3D mesh. Comment on the quality of the 3D. Play around with your system setup until you get an impressive 3D image.