

COMPOSITE PATTERN (CP) STRUCTURED LIGHT ILLUMINATION (SLI)  
11-23-05 LGH

F. Final Project

So far we have stepped through the process of synthesizing, projection/capture, demodulation and phase retrieval of the CP. However, we did not use the best or most optimum techniques. Your job now is to make CP work as well as you can. You may redesign the pattern, re-acquisition, improve your demodulation and to show off your results, you may subtract the background phase from the “bowling ball” phase to reveal the depth information. I will judge your project on the techniques you used, your implementation of them and most important of all, the quality of the retrieved phase for the bowling ball.

Here are some things I am going to try to improve my baseline system:

1. Use carrier only images to (1) characterize the spatial roll-off in frequency and (2) get a better estimate of the carrier correction coefficients. I am expecting to spread the carriers out to 120 cycles/FOV to maybe 200 cycles/FOV.
2. Shadow areas and low albedo areas will contribute to Gibbs Phenomenon. By thresholding the albedo image, we can segment out shadow and other low albedo regions. Creating a binary map of these regions, we can logically map the background composite pattern to these regions thereby minimizing the Gibb phenomenon.
3. For regions above the albedo threshold, if there is a variation of albedo, this variation can still contribute to a Gibbs affect. So we can minimize the affects of albedo gradients by dividing the CP image by the albedo intensity at each pixel.
4. At the ends of the horizontal line segments which we process in the DFT domain, we can reduce the effects of leakage by rolling off the ends. I will use a cosine roll off which has a period twice as long as the lowest carrier frequency.
5. The channels will be bandpass filtered by using a butterworth FIR design which should be much better than the rectangle function and minimize ripple affects.
6. I will use the Hilbert method to demodulate. That is, we bandpass filter as before but suppress one side of the bandpass filter. Inverse DFT and take magnitude which should give the correct demodulation. Show the mathematics for this part and make sure I am correct in my advice.
7. Subtract out phase of the background.