**Miniproject 2: Generation of phase-only hologram**

The objective of this project is to write a program for generating phase-only Fresnel hologram for representing a multiple depth object. A sample program written in the C language is provided in the Canvas for jump starting the project. The program will convert a scene image (in 24bit bmp format) into a 1024x1024 Fresnel phase-only hologram. The scene image is composing of 1024x1024 pixels, evenly divided into a left and a right section. Users can input the depth of each section to the hologram.

Instructions of operating the sample program are given below.

1. Download the project file “phase\_hologram.zip” from the Canvas, and extract all the files into a single directory in the harddisk.

2. Open the project with Microsoft Visual C, build and execute the program.

3. When prompt, input the output filename.

4. When prompt again, input the name of the scene image (without the extension “.bmp”).

5. Next, enter the depth of each section.

6. Wait until the program finished. The hologram will be generated, and its reconstructed image will be saved in the output file.

7. The pixel size of the hologram and the wavelength are set to 8.1um, and 633nm, respectively.

8. Inspect the hologram with say, the Paint software of Window. You should be able to see the reconstructed image.

9. Notice that the reconstructed image is rather poor, as only the phase component is preserved.

The task of this miniproject is given as follows. Tasks A to C are mandatory basic outcomes that are expected to be achieved by all candidates. Task D includes advance outcomes which give additional marks to the miniproject. Tasks E to G are mandatory.

A. Familiarize with the given source code to understand the hologram generation and reconstruction process.

B. Add to the existing program a process to downsample the source image with a grid-cross lattice prior to the generation of the phase-only hologram. Observe the enhancement on the quality of the reconstructed image

C. Experiment with a larger hologram size of 2048x2048, and also with different source images and settings (e.g. distance of each section to hologram, different kinds of source images and downsampling lattice, etc.).

D. Attempt other methods for generation of phase-only hologram, such as but not limited to random noise injection, iterative method, and error diffusion. Save the phase-only hologram in a 24bit bmp file and inspect its content.

E. The outcome of the miniproject will be assessed via demonstration, Q&A, explanation, and a group report. The report should be within 5 pages, summarizing the objective, as well as the essential methodology and findings of the accomplished tasks. Individual contributions in the miniproject should be described in the demonstration and the report.

F. The report should not include the program source codes, and submit as a printed copy via the mail slot beside my office door.

G. The report should be submitted on or before the end of Week 14. If more time is needed, please let me know.