SPIDeRS: Structured Polarization for Invisible Depth and Reflectance Sensing Supplementary Material

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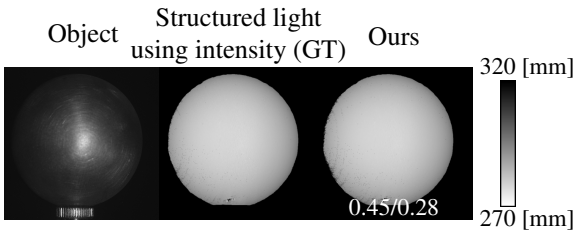

Figure A.1. Reconstructed depth maps of a rough metallic surface. The numbers below each depth map are the mean and median of the depth errors in millimeters. Our method also works well for metallic surface.

A.1. Depth Accuracy of Metallic Surface

Figure A.1 shows the reconstructed depth maps for a rough metallic surface. While pure specular metallic surfaces would be challenging for any projector-camera system as the patterns will not be observed, for a rough metallic surface, our method successfully reconstructs the depth map. The proposed BRDF estimation method, however, is limited to dielectric materials as it uses the FMBRDF model [15].

A.2. Additional Experimental Results

Figure A.2 shows additional experimental results of depth and surface normal reconstruction and relighting. The results show that the accuracy of the depth map reconstructed by our method is comparable with that of structured light using intensity while the capture process is invisible to the naked eye. Our method also fully exploits polarimetric reflection to estimate the per-pixel surface normal and the BRDF, which we can use for qualitatively plausible relighting.

A.3. Limitations

Our analysis of polarimetric reflection is limited to ambient light and local illumination of the polarization projector. Diffuse inter-reflection is not affected by the projected polarization pattern and can be removed together with the diffuse reflection and ambient light. Specular inter-reflection depends on the pattern and can cause decoding errors. Such global illumination effects would also degrade the accuracy of normal and BRDF estimation. Rectifying the effects of global illumination with a spatial polarization pattern would be an important future work.

As mentioned in Appendix A.1, the normal and BRDF estimation is limited to dielectric materials due to the BRDF model. Polarimetric reflection on other materials, however, will also provide rich cues for a surface. By modeling analytical polarimetric and radiometric BRDF models on other materials, we will be able to extend our method to an even wider range of object surfaces.