Computational Projection Mapping for Optical Material Control

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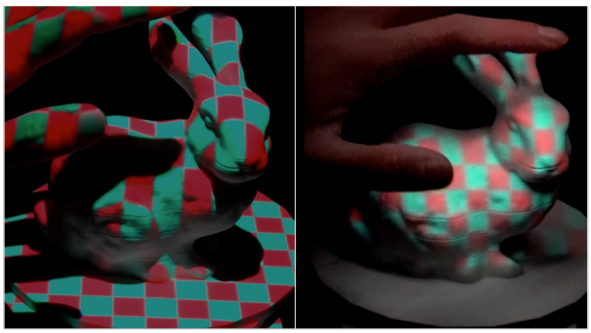

Normal projection mapping Shadowless projection mapping

Projection mapping (aka spatial augmented reality) alters the appearance of a surface in the real world by superimposing computer-generated imagery onto it. While there are enormous expectations for its potential applicability, it is still hard to optically manipulate the surface materials with high fidelity. In particular, the projected results are always suffered from the complex reflectance properties of the surface, such as spatially varying textures, specular reflection, subsurface scattering, and inter-reflection, and also from the technical limitations of the current projector hardware such as low dynamic range, limited aperture size, narrow depth-of-field, and latency. We have developed computational projection mapping technologies to overcome the challenges and realize natural material controls beyond the capability of conventional projection mapping frameworks. The computational projection mapping is an emerging framework of the joint design of hardware, optics, and target surfaces with computational algorithms and perceptual considerations. In this talk, I will introduce a series of our recent works such as shadowless projector to demonstrate the feasibility of the computational projection mapping framework and discuss its future directions.

Reference:

H. Asayama, D. Iwai, and K. Sato, "Fabricating Diminishable Visual Markers for Geometric Registration in Projection Mapping," IEEE Transactions on Visualization and Computer Graphics, 2018.

K. Hiratani, D. Iwai, P. Punpongsanon, and K. Sato, "Shadowless Projector: Suppressing Shadows in Projection Mapping with Micro Mirror Array Plate," In Proceedings of IEEE Conference on Virtual Reality and 3D User Interfaces, 2019. (Best Research Demonstration Runner-up)

P. Punpongsanon, D. Iwai, and K. Sato, "FleXeen: Visually Manipulating Perceived Fabric Bending Stiffness in Spatial Augmented Reality," IEEE Transactions on Visualization and Computer Graphics (in press).

Biography:

Daisuke Iwai received his B.S., M.S., and Ph.D. degrees from Osaka University, Japan, in 2003, 2005, and 2007, respectively. He was a visiting scientist at Bauhaus-University Weimar, Germany, from 2007 to 2008, and a visiting Associate Professor at ETH Zurich, Switzerland, in 2011. He is currently an Associate Professor at the Graduate School of Engineering Science, Osaka University. His research interests include spatial augmented reality and projector-camera systems.
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