Acquiring axially-symmetric transparent objects using single-view transmission imaging

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1. Results
A very simple “environment matting” like acquisition setup (a) which consists of the target object placed between a camera and an LCD panel for the efficient acquisition of axially symmetric transparent objects. (b) A wide range of axially symmetric transparent objects were reconstructed efficiently and accurately by our method. (c) The faithful rendering results show our method can be widely applied for ubiquitous transparent objects in the real world.

2. Previous Work
- Tomographic Reconstruction of Transparent Objects, Trifonov et al. [1]
- Immersion Range Scanning, Huijin et al. [2]

3. Acquisition and Processing
- Axially symmetric transparent object
- Our capture sequence obtains 15 photographs from a single viewpoint:
  - 1 constant white screen illumination
  - 4 patterns consisting of X and Y linear gradients and their inverses
  - 4 patterns of each of the X and Y high frequency gray codes

4. Proposed Method
High quality reconstruction for axially symmetric transparent objects based on a simple acquisition setup and inverse ray tracing

5. N-fold Symmetric Objects
- Virtual boundary of rotational symmetry
- Actual boundary of n-fold symmetry
- Given p and ϕ, curvature of n-polygonal shape is modeled as rotated quadratic by i
- Outer cross-section in n-fold symmetry is geometrically modeled by only a single input parameter, the number of polygon.

6. Conclusion
- Practical approach for high quality reconstruction of axially symmetric transparent objects. Such objects are quite common in the real world and can have very unique, aesthetic and complex shape and appearance.
- Our approach employs a simple environment matting style setup for efficient single view acquisition and robust reconstruction of such transparent objects including estimation of shape and refractive index.
- We demonstrate high quality reconstruction results for a wide range of rotationally symmetric and n-fold symmetric everyday objects.

7. References