Interactive Additive Diffraction Synthesis

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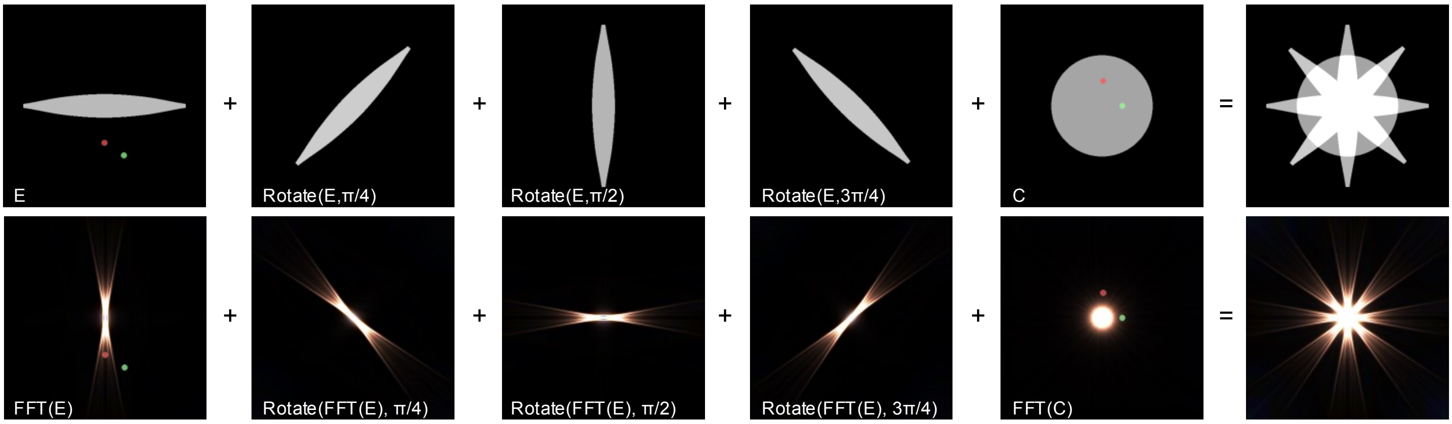
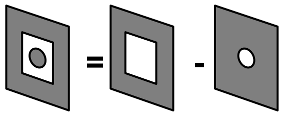


This poster presents a novel scheme of diffraction synthesis, which additively integrates diffraction elements with fast Fourier transform. We decompose a aperture shape into atomic geometric elements to abstract diffraction features. Curved blades (E) and circular core (C) abstract non-symmetric streaks and core highlights, respectively.

Background

- Far-field Fraunhofer diffraction is often approximated as Fourier transform (FT).
- A complex aperture and its diffraction can be broken up to simple apertures and addition/subtraction of their diffractions.



Challenges

- Efficient synthesis of diffraction patterns and their intuitive editing using separable geometric elements
- Since the shape of the aperture indirectly relates to the shape of diffraction by FT, the resulting diffraction pattern is hard to expect in advance.

Our approaches

- Decomposition of the apertures into two key geometric features.
- Apply FFT to individual elements and additively composite their rotations into a single output image.

Advantages

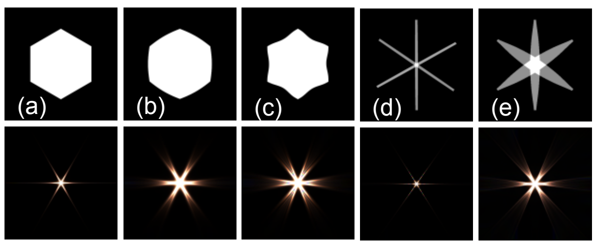
1) Efficient re-generation/synthesis of a diffraction for different number of blades without re-computing its whole-aperture FT
2) Easier to add per-blade details (e.g., by generating single-blade diffractions with different noises and deformations)

Atomic aperture elements

- Curved edges: convex or concave edges having stronger tensions make the diffracted streaks broader (b and c).
- A circular element: the brightness and size of core highlights

Examples

A virtual aperture with three thick lines (d) yields similar patterns to that from a hexagonal aperture (a). The core of diffraction pattern is abstracted to a circular element.



User interaction for diffraction synthesis

Each diffraction element has two control points.
- Red point controls intensity and rotation
- Green point controls the tension of the curves and the oval distortion of the circle