Rotational Particle Tracking of Brownian Polygons
by Optical Fourier Transform Microscopy

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Summary: The rotational trajectories of confined polygonal colloids, which can be used as probes
for bio-microrheology, are tracked using a fast Fourier transform analysis method.

The rotational motion of nonspherical colloidal probe particles attached to or within a cell can potentially be
used to track local morphological changes of the cell and extract related transport properties. However, full three-
dimensional rotational tracking of complex probes can be challenging, especially when measuring dynamics that are
fast on a biological scale. As a simple starting point for approaching measurements of rotational dynamics of
complex probes, we examine the rotational diffusive motion of polygonal colloids made lithographically, dispersed
in water, and confined to a plane by roughness-controlled depletion attractions. By taking fast Fourier transforms
(FFTs) of images of isolated polygons and analyzing the angular position of rays in the FFTs, we determine
rotational trajectories of the particles, independent of their positions. This approach could potentially be used to
track the rotational dynamics of a complex polygonal probe on a region of a motile cell that is quasi-two-
dimensional.