Optical Transfer of the Three-Dimensional Object

B. Roy Frieden

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Abstract

A transfer theory is developed that determines the image space, and three-dimensional image spectrum, of a 3–D object. For both incoherent and coherent illumination, the image is found to obey convolution, transfer, and sampling theorems that resemble the familiar results of ordinary 2-D theory. A 3-D transfer function is related to the pupil function of the image-forming optical system. One result of the theory is that with incoherent illumination, the object image space contains no more than $1/(\lambda^3 f/no.^4)$ degrees of freedom/unit volume, where λ is the wavelength of light. The transfer theory is based on the existence of volumes of stationarity, termed “isotomes;” into which the object must be partitioned. Isotomicity is shown to be approximated, over sufficiently small volumes, in the diffraction-limited case.

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Longitudinal Image Formation*
B. Roy Frieden
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The optical transfer function of an optical system such as a camera, microscope, human eye, or projector specifies how different spatial frequencies are handled by the system. It is used by optical engineers to describe how the optics project light from the object or scene onto a photographic film, detector array, retina, screen, or simply the next item in the optical transmission chain. A variant, the modulation transfer function , neglects phase effects, but is equivalent to the OTF in many situations. Practical example – high-definition video system. The three-dimensional optical transfer function. Calculation. Example. Numerical evaluation. The vectorial transfer function. Measurement. Starting from the point spread function. Using extended test objects for spatially invariant optics. By consequence, the three-dimensional optical transfer function can be defined as the three-dimensional Fourier transform of the impulse response. Although typically only a one-dimensional, or sometimes a two-dimensional section is used, the three-dimensional optical transfer function can improve the understanding of microscopes such as the structured illumination microscope. Optical transfer function or modulation transfer functions are thus generally two-dimensional functions; the following figures shows the two-dimensional equivalent of the ideal and the imperfect system discussed earlier, for an optical system with trefoil, a non-rotational-symmetric aberration. Optical transfer functions are not always real-valued. Optical trapping has been implemented in many areas of physics and biology as a noncontact sample manipulation technique to study the structure and dynamics of nano- and mesoscale objects. It provides a unique approach for manipulating microscopic objects without inducing undesired changes in structure. Stability of Optically Aligned Anisotropic Objects. Before attempting a Bragg CXDI measurement, the angular fluctuations of the trapped particle were measured in each dimension to quantitatively evaluate

e chose cylindrically shaped crystalline ZnO particles as the sample.