

Modeling DIC Microscope Image Formation of Thick Biological Specimen

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A differential interference contrast (DIC) microscope is a noninvasive interferometer for visualizing live, transparent biological cells. A reconstruction of the visualized object shape out of DIC images, preceded by understanding the DIC image formation, is needed for quantifying the morphological information out of DIC images. In particular, the morphology of thick human embryo cells plays a crucial role in the success of *in vitro fertilization* (IVF) procedures. Models of the DIC microscope have been proposed yet have either scalar limiting nature, or that they are not examined for thick objects.

In this work we present the image formation of a spherical thick particle, illuminated by a plane wave, in a DIC microscope. Our model predicts the scattering pattern that would be observed using a vectorial approach based on the Lorentz-Mie Theory. The light is then propagated through a lens using a thin lens model. The highly oscillatory Fresnel diffraction integral, describing the light propagation from the lens to the image plane, is solved using the multivariate Gaussian Quadratures technique. Model predictions are compared with real DIC images of Polystyrene Microspheres.