Dissertation Defense

Mathematical Models and Numerical Methods for Wavefront Reconstruction

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Abstract: Obtaining high resolution images of space objects from ground based telescopes is challenging, and often requires computational post processing methods to remove blur caused by atmospheric turbulence. In order for an image deblurring (deconvolution) algorithm to be effective, it is important to have a good approximation of the blurring operator. In space imaging, the blurring operator is defined in terms of the wavefront of light, and how it is distorted as it propagates through the atmosphere.

In this thesis we consider new mathematical models and algorithms to reconstruct the wavefront, which requires solving a large scale ill-posed inverse problem. We show that by exploiting and fusing information from multiple measurements, we are able to obtain better reconstructed wavefronts than existing methods. In addition, we present results of a parallel implementation utilizing the Trilinos project.

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