The adaptive correction of wave front in turbulent atmosphere by using a reference source

Diploma thesis abstract

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The present paper deals with correction of wave front from a slight star based on the measurement of the wave front the reference. While spreading through the turbulent atmosphere light from the slight star and from the reference star get different phase addition. This phenomenon is known as anisoplanatism. Possibility to attain information about the slight star is based on available correlation between the two wave fronts of spreading through the atmosphere at a small angle between them. Minimization of errors of restoration of wave front can be gained by different methods. In particular, it can be based on the least- squares method or Bayes's method, if a priori information about the atmosphere is known. To solve these questions the modeling method has been used.

The wave front sensor operation was simulated. The wave front Zernike coefficients restoration from the slight star was simulated as well. The methods of Bayes and of least- squares were compared. The propagation of light beams was simulated by spectral method. Turbulence atmosphere was simulated by means of phase shields obtain by the filtration method. The curves describing dispersion saturation of amplitude logarithm fluctuations in increasing distances between the shields or in increasing their intensities, and also similar dependences for dispersion of phase fluctuations. Correlation pairs for correspond Zernike coefficients obtained for a pairs of front of two star were calculated.

The model also makes it possible to obtain correlation matrix of Zernike coefficients for each of examined star (Noll matrix).