Minimum variance control structure for adaptive optics systems

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Abstract

The adaptive optics minimum variance control problem is formulated as a linear-quadratic-Gaussian optimization. The formulation incorporates the wavefront sensor frame integration in discrete-time models of the deformable mirror and incident wavefront. It shows that, under nearly ideal conditions, the resulting minimum variance controller approaches the integral controller commonly used in adaptive optics systems. The inputs to the controller dynamics are obtained from a reconstructor with the maximum a posteriori structure that uses the estimation error covariance of the wavefront error. The ideal conditions assumed to obtain the integral controller are as follows; isotropic first-order (but nonstationary) temporal atmospheric aberrations, no computational loop delay, and no deformable mirror dynamics. The effects of variations in these conditions are examined.

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