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Measured Plate Deformable Mirror Inter-Actuator Cross-talk

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Deformable mirrors (DMs) are able to compensate high spatial frequencies more effectively when its actuators induce a very local influence on the mirror surface. The localization of an influence function is often characterized by inter-actuator cross-talk, which is the ratio of the motion of an adjacent actuator to the motion of the activated neighbor. For certain types of aberrations, there is an optimum of inter-actuator crosstalk. For example, some studies indicate that the optimum cross-talk between actuators on a plate-type DM is 15% for Kolmogorov-spectrum turbulence.

In this application note we are documenting an experiment where we measured the inter-actuator cross-talk on a plate-type deformable mirror (DM). For this application note, we analyzed the influence functions measured on a Shack-Hartmann wavefront sensor from a 42-actuator plate-type DM with a high reflectivity coating. The actuators were separated by 6 mm. The field of view of the wavefront sensor was limited to the lower half of the DM.

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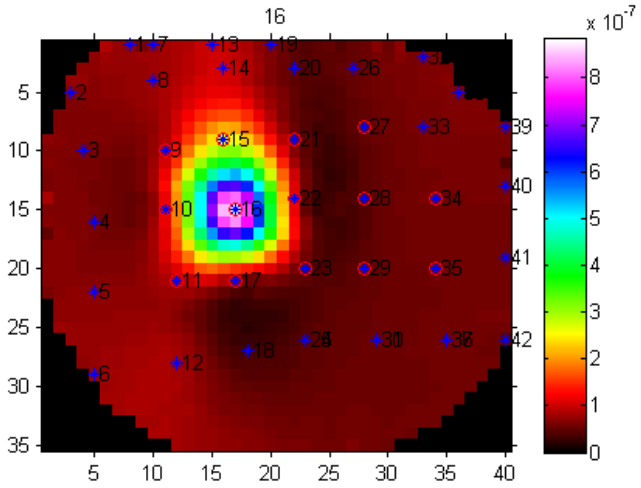

Figure 1 – Image of a measured influence function from the 42-actuator DM on a Shack-Hartmann wavefront sensor and the location of the peak in the measured influence functions of the other actuators.

Figure 1 shows one of the measured influence functions and the positions of the maximum of the reconstructed phase on all the other measured influence functions on the sub-aperture grid. The wavefronts of the measured influence functions were reconstructed with 10-frame averaging, but without triggering, which left a shadow of the previous numbered actuator in the data frame. To avoid this shadow, we calculated the cross-talk based on the next actuator only. We only considered actuators that were near the center of the measured region.

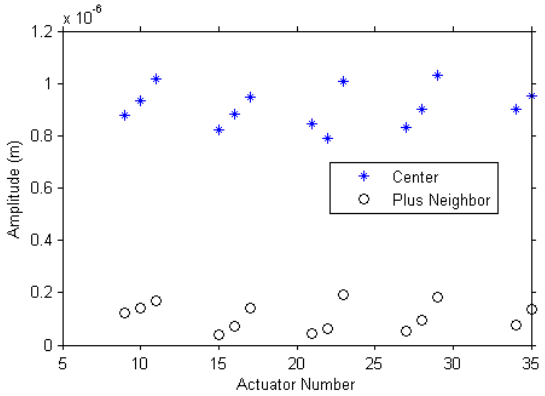

Figure 2 - Measurements of the motion of the primary actuator and its next neighbor for an application of 12.5% of the voltage range.

Figure 2 shows the results of the measurements of the peak of the influence function and the motion at the neighbor. There was an overall tilt term in the background of the measurements that should be eliminated in later experiments. We were able to establish an overall 11.7% inter-actuator crosstalk.