Deriving Convergent Actuator Influences within an Unstable Resonator for Application to the Solid-State Heat Capacity Laser Project

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High temperatures reached during the operation of a Heat Capacity Laser create thermal gradients that lead to intensity variations within the output beam. In this project, an adaptive optics system is used to minimize these aberrations by selectively pushing actuators on a deformable mirror (DM) placed within the cavity of the laser resonator. The influence of each actuator push must be determined, which is currently done by measuring its effect on a single pass through the resonator. To formulate a more efficient control algorithm for the DM, it is necessary to determine how the multiple passes over the pushed actuator, which occur as the beam resonates through the cavity, affect the output wavefront. An empirical representation of the horizontal actuator influence function for an impulse input into the system is calculated, using a fit to a Difference of Gaussians. This impulse response is numerically extrapolated to the convergent response-- the two-dimensional influence function representing the effect of each actuator push upon the final wavefront, after an infinite number of passes through the resonator.