11th World Congress on Structural and Multidisciplinary Optimisation
07th -12th, June 2015, Sydney Australia

Layout optimization of electromagnetic actuators for deformable mirror devices

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Abstract

A major factor in developed countries as of 2015 is the aging of their population, and the desire of the elderly to live longer and more healthfully. However, the longer a person lives, the higher the probability of illness. There are many kinds of diseases, but lifestyle diseases predominate. Lifestyle diseases often include various kinds of complications, and effective treatment depends on accurate diagnosis at an early stage. The development of the eye ground camera has provided a particularly effective diagnostic tool, as it allows direct visualization of blood vessels located at the rear surface of the interior of the eye, enabling doctors to easily distinguish various complicating factors in patients. However diagnostic accuracy may be compromised, due to the particular aberrations in the cornea of an individual's eye, so the eye ground camera must correct for these errors. Variations in the curvature of the cornea can be represented using a Zernike polynomial, which can then be used to correct the errors. Here, we present an optimization method for transforming the shape of a flexible mirror in a device employing roughly two hundred electronic actuators, based on Zernike polynomials and the application of constraint conditions. The design variables are optimized and the number of actuators is reduced. To make this possible we make the evaluation function and the penalty function. The evaluation function are represented in the errors between the objective shape of the mirror and the real shape of the mirror. The shape of the mirror can be transformed into the objective shape by minimizing the evaluation function. The penalty function enables us to make the current value which is very small converge toward zero. Finally, we present numerical examples to verify the efficacy of the proposed method.