



Estimation of freeform surface wavefront from its slopes by a combination method over general shaped aperture

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Freeform surfaces are becoming a new design trend in the optical industry to improve the system performance with a reduced number of optical components. Estimation of freeform wavefront by slope-based sensing modalities is significant in optical testing. To obtain the principal modes of the unknown wavefront and improve the estimation accuracy from its slopes for general shaped aperture of freeform surfaces, a hybrid method for such estimation by combining numerical orthogonal transformation with iterative zonal compensation is presented comprehensively. The slope data is fitted by numerical orthogonal transformation at first to obtain principal modes of the unknown freeform wavefront, and then gradient residuals that could not be represented by the finite chosen modes are addressed by the iterative zonal compensation method to improve reconstruction accuracy, especially for complex wavefront with local steep or sharp variations. The feasibility and superiority of this combination method is verified by numerical simulation. Compared with finite chosen numerical orthogonal gradient polynomials, the hybrid method is effective, accurate, and easily applied to the freeform wavefront estimation from its slopes over the general shaped aperture.

SHORT BIO:

Chaoyang WEI is currently a Professor of Shanghai Institute of Optics and Fine Mechanics (SIOM), Chinese Academy of Sciences (CAS). He received the B.E. degree in optoelectronic technique from Zhengzhou University and the Ph.D. degree in Optical engineering from SIOM. His current research interests include advance optical manufacturing and testing, laser damage etc. He is the outstanding member of Youth Innovation Promotion Association of the CAS and the young member of editorial board of Optical Precision Engineering. He has authored and co-authored more than 50 peer-reviewed papers, and earned the second prize of National Technical Invention Award, the first prize of Shanghai Technical Invention Award etc.