

Generalization of Zernike basis for a variety of important optical apertures

Chelo Ferreira¹, José Luis López², Rafael Navarro³, Ester Pérez Sinusía¹

SUMMARY

Zernike polynomials are commonly used to represent the wavefront phase on circular optical apertures, since they form a complete and orthonormal basis on the unit disk. In [2] we present a generalization of the Zernike basis introduced in [1] for a variety of important optical apertures, paying special attention to polygons and the polygonal facets present in segmented mirror telescopes. We consider a piece-wise diffeomorphism that transforms the unit disk into the polygon under consideration. We use this mapping to define a Zernike-like orthonormal system over the polygon. We also consider ensembles of polygonal facets that are essential in the design of segmented mirror telescopes. The general form and the explicit expressions for a typical example of telescope optical aperture are provided.

Keywords: Zernike polynomials, orthonormal systems, optical apertures, polygonal facets, segmented mirror telescopes.

AMS Classification: 41A10, 41A63, 78M99, 85-08.

References

- [1] Rafael Navarro, José L. López, José A. Díaz and Ester Pérez Sinusía. Generalization of Zernike polynomials for regular portions of circles and ellipses. *Optics Express* **22** (18), 21263–21279, 2014.
- [2] Chelo Ferreira, José L. López, Rafael Navarro and Ester Pérez Sinusía. Zernike-like systems in polygons and polygonal facets. *Applied Optics* **54** (21), 6575–6583, 2015.

¹Departamento de Matemática Aplicada & IUMA
Universidad de Zaragoza
email: cferrei@unizar.es, ester.perez@unizar.es

²Departamento de Ingeniería Matemática e Informática
Universidad Pública de Navarra
email: jl.lopez@unavarra.es

³ICMA, Consejo Superior de Investigaciones Científicas & Universidad de Zaragoza
Universidad Pública de Navarra
email: rafaelnb@unizar.es