DELFT UNIVERSITY OF TECHNOLOGY

Wavefront Generation

SC4045 CONTROL FOR HIGH RESOLUTION IMAGING

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1 ZERNIKE POLYNOMIALS GENERATION

The main task is to *implement a generator of Zernike polynomials* according to the formula in [1, Definition 2.2]. The function should generate phase distributions for square and circular grids given a single index (Noll's index) and the necessary sample sizes per axis. The transformation from the two indices that characterize the polynomials in [1, Definition 2.2] to only one index can be found in [2]. Besides the implementation it is also required that you accomplish a number of subtasks:

1. Inspecting [1, Figure 2.9], explain the meaning of the parameter u and v that characterize the Zernike polynomials Z_u^v.
2. Identify the importance of Zernike polynomials in an optical context.

Important examples and references can be found in [3], [4], and [5].

2 TURBULENCE MODEL

Having generated some phase distributions modelled by Zernike polynomials, *implement a Kolmogorov and a von Kármán turbulence generator*. The formulas in which to base the implementation are provided in [1, Eq. 1.11, Eq. 1.12]. The following subtaks are to be performed:

1. Analyse the influence of the inner scale ℓ_0, the outer scale $Ł_0$, and the Fried parameter r_0 in each of the turbulence mdoels. Plot the results and present any relevant differences between the von Kármán and the Kolmogorov turbulence models.

REFERENCES

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