Two vacancies in the Computational Illumination Optics group at Eindhoven University of Technology

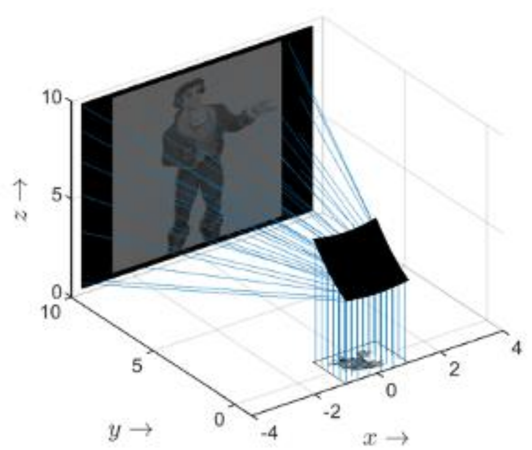
Eindhoven University of Technology has issued a call for 25 new positions (assistant, associate and full professors) in the Department of Mathematics and Computer Science; see https://jobs.tue.nl/en/vacancy/assistant-associate-and-full-professors-mathematics-and-computer-science-982722.html. In the framework of this call there are two vacancies in the Computational Illumination Optics group.

The Computational Illumination Optics Group

The Computational Illumination Optics group is one of the few mathematics groups worldwide working on optical design problems from illumination optics. The group has a healthy portfolio of PhD positions and close collaborations with industrial partners. The group consists of two full FTEs at Eindhoven University of Technology and one part-time professor and is looking for two new team members.

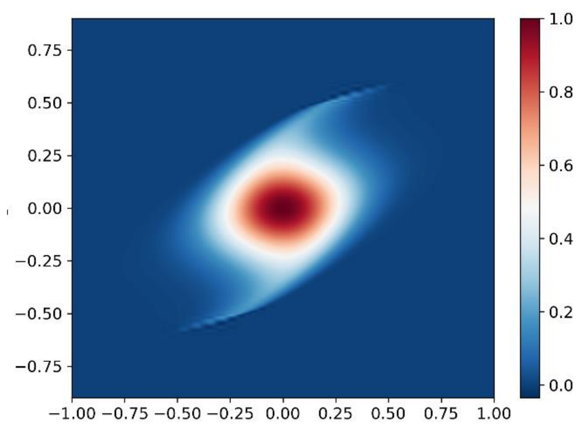
The group has three research tracks: freeform design, improved direct methods and imaging optics; for more details see https://www.win.tue.nl/~martijna/Optics/.

Freeform design: The goal in freeform design is to compute the shapes of optical surfaces (reflector/lens) that convert a given source distribution, typically LED, into a desired target distribution. The surfaces are referred to as freeform since they do not have any symmetries. The governing equation for these problems is a fully nonlinear PDE of Monge-Ampère type.



Key publication: Anthonissen, M. J. H., Romijn, L. B., ten Thije Boonkkamp, J. H. M., & IJzerman, W. L. (2021). *Unified mathematical framework for a class of fundamental freeform optical systems.* Optics Express, 29(20), 31650-31664. https://doi.org/10.1364/OE.438920.

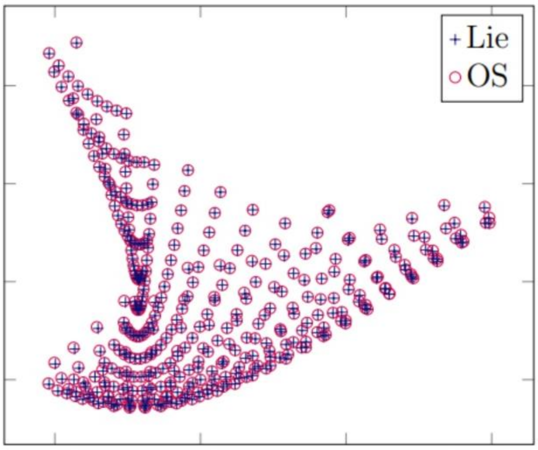
Improved direct methods: Direct methods, such as ray tracing, compute the target distribution given the source distribution and the layout of the optical system. These methods must be embedded in an iterative procedure to compute the final design and are based on Monte-Carlo simulation. They are known to have slow convergence. Using the Hamiltonian structure of the system and advanced numerical schemes for PDEs, we are working on more efficient and accurate methods.



Key publication: van Gestel, R. A. M., Anthonissen, M. J. H., ten Thije Boonkkamp, J. H. M., & IJzerman, W. L. (2021). *An energy conservative hp-method for*

Liouville's equation of geometrical optics. Journal of Scientific Computing, 89, [27]. https://doi.org/10.1007/s10915-021-01612-x.

Imaging optics: The third research track is imaging, where the goal is to form a very precise image of an object, minimizing aberrations. Light propagation is described in terms of Lie transformations.



Key publication: Barion, A., Anthonissen, M. J. H., ten Thije Boonkkamp, J. H. M., & IJzerman, W. L. (2022). *Alternative computation of the Seidel aberration coefficients using the Lie algebraic method*. Journal of the Optical Society of America A, Optics, Image Science and Vision, 39(9), 1603-1615. https://doi.org/10.1364/JOSAA.465900

(Mathematical) disciplines of importance in our research are, among others, geometrical optics, ray tracing, (numerical) PDEs, transport theory, nonlinear optimization, Lie operators, and Hamiltonian systems.

The vacancies

We are looking for two candidates to enforce our team:

The *first candidate* should be an expert on numerical analysis, in particular numerical methods for PDEs; the candidate should have ample experience in sophisticated discretization and solution methods and be able to translate these in efficient simulation code. Moreover, the candidate should have experience with mathematical modelling in the physical sciences.

The *second candidate* should be an expert in modeling physical phenomena, e.g., including scattering in an optical design model. The candidate should be able to analyze these models and have a profound knowledge of (numerical) PDEs.