Editorial

Fabian Duerr* and Alois Herkommer

Why does interdisciplinary research matter?

https://doi.org/10.1515/aot-2019-0026

In this day and age, science and research need to come up with better and more effective solutions for various challenges and to analyse complex systems that often call for crossing disciplinary boundaries in order to generate new knowledge and to drive innovation. In essence there are typically three main arguments in favour of interdisciplinary research. First, complex problems are often not suitable for single-discipline research anymore. Second, discoveries and advances in research and development are more likely to happen at the borders between multiple scientific fields. Finally, and most importantly, the interactions between researchers from different disciplines benefit each individual and broaden their horizons.

On the other hand, counter arguments against interdisciplinary research work very similarly, where some might fear that interdisciplinary efforts might drain time, funds and resources from individual disciplines. Thus, interdisciplinary research should only be conducted where it truly makes sense and generates an impact. Therefore, the added value of a virtual prototype can economically and even philosophically be discussed.

The research and development of advanced optical technologies and systems are a prime example where interdisciplinary research does matter, and it is much more common than one might think. Most optical technologies naturally bring together more than one scientific field in areas such as optical material processing, optics in medical applications or optics in communication and information technology, for example. Given the diverse range of high-tech sectors that are impacted, optics and photonics are key enabling technologies for the 21st century. Interdisciplinary simulations and models are often among the very first essential steps and at the core of many research efforts and they are almost mandatory as novel advanced systems are being developed and used.

We start this special issue with an article by Pompe-Alama, which investigates the 'The changing face of scientific practice–seeing things virtually'.

Stock et al. focus on the simulation and analysis of real-world imaging systems including freeform optical components. The as-built performance of such systems largely depends on manufacturing and alignment constraints, which can limit the potential of designed systems.

In the following article by Störkle et al., the authors show how especially high-performance or active optical systems require a thorough understanding of the impact of mechanical vibrations or turbulence effects onto the optical characteristics.

Reichenzer et al. illustrate the importance of interdisciplinary simulation models where the interplay between the optical system and the surrounding physical world of imperfectness and disturbances is of great importance.

Finally, Livshits et al. present their interdisciplinary approach for simulation of starting points for optical and architectural design.

In this editorial, it was our attempt to address these and related topics of interdisciplinary research in the field of optics. We sincerely thank all the contributing authors, the reviewers, and the Editor-in-Chief, the *Advance Optical Technologies* (*AOT*) team and the publisher for their support and for realising this special issue.

Dear reader, we hope you enjoy reading through this selection of articles.

Fabian Duerr and Alois Herkommer

***Corresponding author: Fabian Duerr,** VUB Brussels, Vollezelestraat 46, 1755 Gooik, Brussels, Belgium, e-mail: fduerr@b-phot.org
Alois Herkommer: Universität Stuttgart, Institut für Technische Optik, Pfaffenwaldring 9, 70569 Stuttgart, Germany

Fabian Duerr
VUB Brussels, Vollezelestraat 46, 1755 Gooik, Brussels, Belgium
fduerr@b-phot.org

Fabian Duerr graduated with a degree in Physics in 2008 from the Karlsruhe Institute of Technology (KIT), Germany and received his PhD in 2013 at the Applied Physics and Photonics Department, Vrije Universiteit Brussel (VUB). Since 2013 as an FWO post-doctoral research fellow, and since 2016 as a research professor, he is responsible for an optical design group that explores freeform optics solutions for LED-lighting, laser applications and novel imaging systems.

Alois Herkommer
Universität Stuttgart, Institut für Technische Optik, Pfaffenwaldring 9, 70569 Stuttgart, Germany

Alois Herkommer received his PhD in Physics in 1995 from the University of Ulm in the area of quantum optics. In 1996 he joined Carl Zeiss and worked on the optical design of high-performance lithographic and metrology systems. From 2000 to 2005 he was with the optical design group at Carl Zeiss Laser Optics GmbH. Afterwards he headed the illumination design group and later the systems design group at the Carl Zeiss SMT GmbH. In 2011 he joined the Institut für Technische Optik at the University of Stuttgart. His research interests include: optical design of imaging and illumination systems, novel optical systems concepts, optical system analysis and simulation, design and simulation methods, medical applications of optical systems.