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Master in Photonics – “PHOTONICS BCN” Master ERASMUS Mundus “EuroPhotonics”

MASTER THESIS PROPOSAL

Dates: April 2021 - September 2022

Laboratory: Optical Design and Assembly

Institution: ASE Optics Europe

City, Country: El Prat de Llobregat, Spain

Title of the master thesis: Investigation of the effects of tolerances on optical system performance - a comparison of simulation and built systems: simulation and analysis focus

Name of the master thesis supervisor and co-supervisor: Thomas Siegel

(for external proposals a co-supervisor from the Master program is needed)

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Keywords: optical design, optical tolerances, optical systems, simulation, opto-mechanics, zemax

Summary of the subject (maximum 1 page):

The fabrication tolerances of high-end optical systems have an impact on the performance and assembly cost of optical systems. Optical simulation software such as Zemax or CodeV offer functionalities for performing the tolerance analysis of the individual optical components within complex optical assemblies. This tolerance analysis allows the optical designer to set requirements on how to mount the optics. A wide number of optics mounting techniques are available for the opto-mechanical designer, differing greatly in their complexity, precision, assembly time and ultimately cost. A thorough understanding of the propagation of the tolerances through different mounting geometries can improve the tolerance simulations and help selecting the most adequate mounting geometry to achieve the required as-built performance.

ASE Optics counts with licences of optical simulation software (both Code V and Zemax) as well as an optical assembly facility with the capacity to measure individual optical surface centring and tilt (Opticentric and Optisurf instruments, Trioptics TM) and the final optical



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performance of the assembled system (wavefront sensor). This gives the complete tool kit for the selected student to understand the relation from simulated tolerance analysis, to component fabrication tolerance definition and through to opto-mechanical assembly characterization and performance evaluation. The selected candidate would get the necessary training to be able to run tolerance analyses in custom optical systems designed by ASE Optics, learn to characterize individual optical elements position within a complex optical assembly, and learn the characterize optical quality through wavefront measurement. The student will be expected to take a wholistic view of the tolerancing and its real-world implementation to relate simulation and measurement beyond the current associated understanding.

This is a highly practical, multi-skill project, where the student will become familiar with all aspects of optical systems from simulation, to manufacture and characterization, working with optical designers, opto-mechanical engineers and laboratory staff.

The technical work throughout the project will take place collaboratively between two Masters students, this MSc thesis will have a stronger simulation and analysis focus.

Additional information (if needed):

The candidate should have a good understanding of optics, both in theory and laboratory.

Direct previous experience in optical simulation software such as Zemax or CodeV would be a plus.

The candidate should have some experience in the handling of optics in the laboratory and be aware of the basic concepts of optical metrology and optical quality.