Master project: 3D printing of diffraction-limited micro-optics

Background information
ASML produces semiconductor lithography scanners that perform with nanometer accuracy at a very high speed. This is achieved thanks to a combination of complex optical sensors that are based on state-of-the-art optical components. We are seeking to significantly miniaturize some of these sensors and are therefore looking for new ways to manufacture miniaturized lenses and curved mirrors with typical dimensions between 100 µm and 1 mm. One method of interest for prototyping and manufacturing of such small optics is 3D printing by Direct Laser Writing. Our research department therefore seeks to collaborate with the Integrated Optical Systems (IOS) group of the University of Twente to investigate 3D printing of lenses and mirrors using a high-resolution two-photon polymerization printer at MESA+.

Your assignment
Your assignment in this project will be to design, manufacture and characterize the accuracy of optical surfaces of 3D printed micro-mirrors. You will use an optical interferometer set-up at ASML to measure the shape of the wavefront of a laser beam that is reflected by a curved micro-mirror. The shape of the reflected wavefront will provide information about the accuracy of the optical surface of the micro-mirror. The ultimate goal of this project is to print curved micro-mirrors that enable focusing of a laser beam to a diffraction-limited spot size. This requires that the optical surface of the 3D printed micro-mirror deviates from its perfect shape by at most a fraction of the wavelength of the laser beam, or a few tens of nanometers. You will investigate the accuracy and repeatability of the 3D printing system and the 3D printing process. You will identify root causes for measured imperfections in 3D printed optical surfaces and investigate the feasibility of methods to compensate for such effects in the initial design of the optical surface. Finally, you will assess the feasibility of 3D printing of diffraction-limited off-axis ellipsoidal and parabolic micro-mirrors for future ASML applications. You will work in ASML Research in Veldhoven and at the IOS group at University of Twente.

Your profile
You are a student working towards a MSc in Applied Physics with an interest in experimental optics and optical imaging theory. You should have good communication skills and willing to work in a team but also independently.

What ASML offers
Your Master project will be in one of the leading Dutch corporations, gaining valuable experience in a highly dynamic environment. You will receive a monthly allowance of 500 euro (maximum), plus a possible housing or travel allowance. In addition, you'll get expert, practical guidance and the chance to work in and experience a dynamic, innovative team environment.

ASML: Be part of progress
We make machines that make chips – the hearts of the devices that keep us informed, entertained and safe; that improve our quality of life and help to tackle the world's toughest problems.

We build some of the most amazing machines that you will ever see, and the software to run them. Never satisfied, we measure our performance in units that begin with pico or nano.

We believe we can always do better. We believe the winning idea can come from anyone. We love what we do – not because it's easy, but because it's hard.

Students: Getting ready for real-world R&D
Pushing technology further is teamwork, we have a strong R&D team with major sites on three continents. Dozens of diverse, interdisciplinary teams work in parallel to meet a challenging development schedule.

In such an environment, your colleagues may be sitting next door, or they could be thousands of kilometers away in a different country, or even working for a different company.

A Master project at ASML is your opportunity to get to know this world of industrial-strength R&D and get a feel for that excites you most. Will you design a part of the machine, or make sure it gets built to the tightest possible specifications? Will you write software that drives the system to its best performance, or work side-by-side with the engineers of our customers in a fab, optimizing a system to the requirements of the customer?

How will you be part of progress?

For more information contact:

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