

## Computer Science | Mathematics Graduation Internship: Continuous Wafermap as a Mathematical Model

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Company: ASML

Location: Veldhoven

Category: computer-and-mathematical

### Introduction

Are you a master student in the field of Computer Science, Mathematics, Physics, or something related? Are you looking for a graduation internship? If yes, one of the assignments below could be interesting for you!

### Background information

Continuous wafermap (CWM) is a mathematical model that is developed within ASML. The major goal of the CWM is to provide a continuous and differentiable representation of a wafermap while eliminating the noise from the discrete measured topography data.

The CWM tries to provide the most close-to-reality model of different contributors (a.k.a components) to the exposed wafer topography. This includes the bare wafer and the device topography as well as the measurement noise.

The CWM employs a least square fit minimization approach to provide the topography of each component separately. Some constraints in the form of penalty terms are added to ensure a physically meaningful representation of each component.

### Your assignment

Within the Metrology Leveling group, we have two available assignments. Depending on your interests and the match, one of the following assignments will be assigned to you.

When applying, please indicate your preference in a cover letter.

### Assignment 1 - Repeated pattern recognition and removal

Despite applying the penalty terms, it is seen that in some cases there exist a crosstalk among the components of a CWM. As the device topography map has a repeated pattern, so is the crosstalk in the bare wafer map. It is crucial to detect the repeated device pattern in the bare wafer map and remove it as a post processing step.

The goal of this assignment is to gain a comprehensive understanding about the existing methods in the field of repeated pattern recognition. The literature review will be then followed by proposing the most feasible solution (with respect to accuracy and computation cost) to the existing problem.

### **Assignment 2 - Constrained Continuous Wafermap**

Despite applying the penalty terms, it is seen that in some cases the components obtain unexpected values. Therefore, it is beneficial to apply bound constraints to the minimization problem while avoiding iterative numerical approaches.

The main goal of this assignment is to provide a mathematical approach to constrain the CWM components while having the least impact on the existing computation cost.

### **Your profile**

To be the perfect match for one of the internships, you:

Are a master student looking for a graduation assignment in the field of Mathematics, Computer Science, Physics or a related technical field;

You have experience in some of the following items: MATLAB, image processing, algorithm development, signal processing, mathematical optimization techniques and data analysis;

Are capable to conduct independent research, and are a true teamplayer;

Possess proficient communication skills in English, both written and verbally.

The start date of the assignments will be as soon as possible. The internship has a minimum duration of 5 months, for 5 days per week (minimum 3 days on-site).

### **Change the world – one nanometer at a time**

Become an intern at a Dutch company that's a global industry leader. You'll gain valuable experience in a highly innovative environment – one that sparks your imagination and creativity. In addition to a monthly internship allowance of maximum €600 (plus a possible housing and free public transport), you'll get practical guidance from experts in the field and

the chance to work in and experience a dynamic team environment.

### **ASML - be part of progress**

ASML is a high-tech company headquartered in the Netherlands.

We manufacture the complex lithography machines that chipmakers use to produce integrated circuits, or computer chips. What we do is at the heart of all the electronic devices that keep us informed, entertained and connected. Every day, you use electronics that simply wouldn't exist without our machines.

Behind ASML's innovations are engineers who think ahead. The people who work at our company include some of the most creative minds in physics, electrical engineering, mathematics, chemistry, mechatronics, optics, mechanical engineering, computer science and fields which are not technical oriented.

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**

We're a global team of about 39,000 people of 140 different nationalities and counting.

Headquartered in Europe's top tech hub, the Brainport Eindhoven region in the Netherlands, our operations are spread across Europe, Asia and the US.

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.

An internship at ASML is the opportunity to get to know not only the world of industrial-strength R&D, but yourself – you'll discover just what 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?

### **#ASMLEarlycareer**

#### **Diversity and inclusion**

ASML is an Equal Opportunity Employer that values and respects the importance of a diverse and inclusive workforce. It is the policy of the company to recruit, hire, train and promote persons in all job titles without regard to race, color, religion, sex, age, national origin, veteran status, disability, sexual orientation, or gender identity. We recognize that diversity and inclusion is a driving force in the success of our company.

Need to know more about applying for a job at ASML? Read our .

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