Teaching CV

Jost Adam

SDU eScience Centre

SDU Mechatronics

CIM - Centre for Industrial Mechanics

Department of Mechanical and Electrical Engineering

Postal address:
Alsion 2
6400
Sønderborg
Denmark
Email: jostadam@sdu.dk, jostadam@mci.sdu.dk
Phone: 65508209

Pedagogical Experience

I obtained my first pedagogical experience as a student teaching assistant at the Faculty for Mathematics at the Christian-Albrechts-Universität (CAU), Kiel, Germany. During this time (2000 - 2004), my responsibilities included teaching exercise courses for “Analysis I to III”, “Functional Analysis” and “Complex Analysis”.

I gained further knowledge during my PhD program, as a research and teaching assistant at the Computational Electromagnetics Group, CAU. During this time (2004 - 2008), I was permanently involved in teaching, and I taught tutorial sessions in the courses “Electromagnetic Theory I & II,” “Mathematical Methods in Field Theory,” “Computational Electromagnetics,” “Electromagnetic Compatibility.” Furthermore, I was involved in organising and conducting seminars, supervising student labs, and supervising undergraduate and master’s degree projects. Teaching at this early stage of my career was a useful experience; it allowed me to gain confidence in in-class teaching and I learned to convey the key aspects of a topic. Supervising undergraduate and master’s degree projects provided me with a first experience in research supervision.

After joining the Integrated Systems and Photonics Group at CAU, I got for the first time the opportunity to teach courses as the responsible teacher and to develop new courses. In 2010, I developed the course “Micro- and Nanooptics”. The course targeted master’s degree students in the first year of their master’s studies. I refined this course in 2012 during my appointment as “Vertretungsprofessor” at the Integrated Systems and Photonics Group at CAU. My overall teaching duties at this appointment further included the BSc lecture “Fundamentals of Electrical Engineering I & II,” the MSc “Lab Course Optoelectronics,” the MSc Seminar “Integrated Systems and Photonics,” the BSc Lab Course “Micro-Nano-Opto Systems,” and the BSc lecture “Optical Systems.”

My current position as associate professor at the Mads Clausen Institute (MCI), University of Southern Denmark (SDU) so far included the fourth-semester BSc lecture “Thermodynamics (THER),” the first-semester MSc lectures “Modeling of Mechatronic Systems (MMS)” and “Optimisation and Image Processing (OIP),” as well as parts of the second-semester MSc lectures “Mathematical Modelling of Mechatronic Systems I (MMM1)” and “Computational Multi-Physics (CMP)”.

Already in my early stages as a postdoc, I got the opportunity to get involved in PhD student supervision. PhD student supervision at the Integrated and Photonics Group at CAU is carried out in teams where postdocs are teamed up with the group leader supervise a student. I benefited from this structure since it gave me the opportunity to gain extensive experience in PhD student supervision even though I was not yet formally allowed to be main supervisor. PhD students on the other hand benefit from this structure, since young researchers typically have more resources available to support students, compared to a senior. During my postdoctoral stage at the UCLA Photonics Laboratory I was able to continue this path of PhD student co-supervision. During my appointment as “Vertretungsprofessor” and the time thereafter, I had the opportunity to become the part-time main supervisor and also evaluation committee member of PhD students I already co-supervised during my first postdoc stage in Kiel. My position as assistant/associate professor at MCI up to now included the main and co-supervision of three concluded PhD theses.

Undergraduate and Postgraduate Courses (Full Responsibility)

My (fully responsible) teaching experience totals in 143 ECTS so far (Jan 2019). For a summary of my undergraduate and postgraduate teaching, and for additional details on courses I have been teaching, I refer to the table below.

Spring 2019 (MCI/SDU)	Lecture “Computational Multi-Physics” | MSc | 10 ECTS
Fall 2018 (MCI/SDU)	Lecture “Optimisation and Image Processing” | MSc | 5 ECTS
Spring 2018 (MCI/SDU)	Lecture “Mathematical Modelling of Mechatronic Systems I” | MSc | 10 ECTS

Fall 2017 (MCI/SDU)	Lecture “Modeling of Mechatronic Systems” | MSc | 5 ECTS
Spring 2017 (MCI/SDU)	Lecture “Mathematical Modelling of Mechatronic Systems I” | MSc | 10 ECTS
Fall 2016 (MCI/SDU)	Lecture “Modeling of Mechatronic Systems” | MSc | 5 ECTS
Spring 2016 (MCI/SDU)	Lecture “Mathematical Modelling of Mechatronic Systems I” | MSc | 10 ECTS
Spring 2016 (MCI/SDU)	Lecture “Thermodynamics” | BSc | 5 ECTS
Fall 2015 (MCI/SDU)	Lecture “Modeling of Mechatronic Systems” | MSc | 5 ECTS
Spring 2015 (MCI/SDU)	Lecture “Mathematical Modelling of Mechatronic Systems I” | MSc | 10 ECTS
Spring 2015 (MCI/SDU)	Lecture “Thermodynamics” | BSc | 5 ECTS
Summer 2013 (CAU)	Lecture “Fundamentals of Electrical Engineering II” | BSc | 7 ECTS
Summer 2013 (CAU)	Lecture “Optical Systems” | BSc | 4 ECTS
Summer 2013 (CAU)	Lab Course “Optoelectronics” | MSc | 4 ECTS
Summer 2013 (CAU)	Lab Course “Micro-Nano-Opto Systems” | BSc | 4 ECTS
Summer 2013 (CAU)	Seminar “Integrated Systems and Photonics” | MSc + PhD | 4 ECTS
Summer 2013 (CAU)	BSc Project | BSc | 4 ECTS
Winter 2012/13 (CAU)	Lecture “Fundamentals of Electrical Engineering I” | BSc | 7 ECTS
Winter 2012/13 (CAU)	Lecture “Micro- and Nanooptics” | MSc | 4 ECTS
Winter 2012/13 (CAU)	Lab Course “Optoelectronics” | MSc | 4 ECTS
Winter 2012/13 (CAU)	Seminar “Integrated Systems and Photonics” | MSc + PhD | 4 ECTS
Winter 2012/13 (CAU)	BSc Project | BSc | 4 ECTS
Winter 2010/11 (CAU)	Lecture “Micro- and Nanooptics” | MSc | 4 ECTS

Teaching Assistance

The following list is an overview of tutorials and computer lab courses I conducted as a teaching assistant at Kiel University (CAU)

2008 - 2014	PostDoc (Integrated Systems and Photonics, CAU): Several substitute lectures for “Fundamentals of Electrical Engineering I &II” Tutorials and substitute lectures for “Photonic Components” Tutorials “Circuit simulation with Qucs I &II”
2004 - 2008	PhD (Computational Electromagnetics Group, CAU): Tutorials for “Electromagnetic Theory I &II” Tutorials and Computer Lab for “Mathematical Methods in Field Theory” Tutorials and Computer Lab for “Computational Electromagnetics” Tutorials for “Electromagnetic Compatibility”
1998 - 2002	Student (Mathematics, CAU): Tutorials for “Analysis I to III”, “Functional Analysis” and “Complex Analysis”

Supervised and Co-Supervised Theses (BSc, MSc, PhD)

I concluded the following thesis supervisions at the Integrated Systems and Photonics Group, Kiel University (CAU), at the Photonics Laboratory, University of California, Los Angeles (UCLA) and at the Mads Clausen Institute, University of Southern Denmark (SDU).

PhD (SDU)	Plasmonic nanostructures for organic solar cells
PhD (SDU)	Organic nanofibers in hybrid plasmonic systems
PhD (SDU)	Mathematical modeling of ultrasound propagation in multi-phase flow (Industrial PhD in cooperation with SIEMENS Flow)
PhD (UCLA)	FPGA-based real-time data processing for the STEAM imaging system
PhD (CAU)	Integration of optoelectronics and photonic crystals for lab-on-chip systems
PhD (CAU)	Nanostructures for emission control in organic light-emitting layers
PhD (CAU)	Active micro-optic devices based on tunable thin film resonators
PhD (CAU)	Tuneable thin film filters with applications in active micro-optics <hr>
MSc (SDU)	Anomaly Detection in HVAC Systems Using Machine Learning
	Industrial MSc Thesis with Danfoss Drives
	BHJ Fonden Best Matster Project Price 2019!
MSc (SDU)	Active vibration damping on an acoustic encapsulation (Industrial MSc Thesis with AMK Automotive)
MSc (SDU)	Design and modelling of electromagnetic actuation in MEMS switches
MSc (SDU/CAU)	Light out-coupling from nanostructured organic light emitting diodes: a coupledmode theory approach
MSc (CAU)	Nanostructured electrodes and their use in organic solar cells
MSc (CAU)	Conception and realisation of dielectric elastomer-based micro-optics
MSc (UCLA)	FPGA-based data acquisition and image reconstruction for high-throughput phase contrast microscopy <hr>
BSc (SDU)	The Air B - a thermodynamically driven device for ghost driver prevention
BSc (CAU)	Coupled-mode diffraction analysis for waveguide structures with multi-periodic gratings
BSc (CAU)	Optical sensors in robotics: performance in obstacle avoidance and navigational tasks
BSc (CAU)	Simulation and characterisation of waveguides with multi-periodic gratings
BSc (CAU)	Fabrication and characterisation of elastic polymer membrane photonic crystals
BSc (CAU)	Conception and realisation of a test strip with an integrated nano-optic biosensor
BSc (CAU)	Construction of an infrared camera test bench
BSc (CAU)	Optimisation of a thermally tuneable elastomer-based virtually imaged phased array (VIPA)

Relevant Pedagogical Training Courses

In the years prior to the **Lecturer Training Program at SDU**, I attended the following training courses to advance my teaching skills:

Jan 2012	“Online Teaching,” PostDoc Career Lecturing Skills Workshop, UCLA
2009 and 2010	“University Didactics Seminar” (and advanced training), Christian-Albrechts-Universität zu Kiel (CAU)
Oct 2011	“Lecturing for Learning,” PostDoc Career Lecturing Skills Workshop, UCLA

Teaching Philosophy

The goals of teaching often reflect the expectations of the different interest groups involved in teaching, namely the teachers, the students, and the potential employer. Teachers often see teaching as the transfer of knowledge and skills and typically formulate goals in terms of content. Students probably see this knowledge transfer as well, but they may connect it with the question “What is important for my career?” and filter accordingly. The probably most significant goal of teaching, however, becomes obvious if one takes a look from the future employer’s perspective: the goal of our teaching should be to teach the competence to understand how to conceive, design, implement, and operate complex value-added products in a modern, team-based working environment. Knowledge transfer can be seen as teaching’s short term effect, as knowledge can be lost if it is obtained by superficial learning or not developed further. The desired long-term effect of teaching, however, should be competence, i.e., the ability to apply, combine, and further develop knowledge and skills. Competence requires experience, which is automatically gained in project-based teaching such as master’s degree projects or during PhD work. But even in conventional courses we can teach competence by providing students with valuable learning activities that enforce in-depth learning. To be able to do this, it is helpful to analyse how students learn.

How Students Learn:
Studying is demanding for students, especially in an international university environment that brings together students from various cultural backgrounds and with diverse experiences and skills. Students may feel pressed by competition and they often take a large number of courses simultaneously. They are hence forced to efficiently allocate their time and to choose between a surface approach to learning or an in-depth approach. If students are motivated and interested in a course and have the required background knowledge, they will naturally take a deep approach to learning and strive to develop a well-structured, profound working knowledge. Other students, who are less motivated (or lack time), may decide to take a surface approach. Surface learning is characterised, e.g., by memorising and developing narrow problem-solving strategies that match typical assessment tasks in the final exam. The only goal of surface learning is passing this exam as opposed to building competence.

In conclusion, a course should be designed to take into account the students' diverse backgrounds. It should further motivate (and potentially force) students to gather an in-depth
knowledge in order to reach the desired goal.

Course Design: A (quite) representative course framework

The following exemplary summarises my conclusions on course design that I initially implemented when designing the lecture "Micro- & Nanooptics" in 2010 and refined it in the years thereafter. The course provides students in the first year of their master's degree studies with fundamental mathematical models and tools to describe common techniques used in state-of-the-art micro- and nano-optical systems. The mathematical nature and the large number of concepts treated in the course are the main challenges from a course design point of view.During the past years, this framework turned out to hold for all courses in my portfolio, with very little exceptions. I experienced that, if not all students have the desired background knowledge and skills, it can be challenging to provide a hands-on experience in a rather theoretical subject. My course design's goal is to address each topic multiple times by different learning activities. I thereby target that students with different preferences and backgrounds can respond at least to one of them. This explicitly includes to provide a hands-on experience in order to promote in-depth learning and to build competence. This is achieved by assigning preparation tasks before the lectures, providing tutorial sessions, and offering computational or analytical homework projects. The preparation tasks consist of reading assignments and small problems that are designed to help the students recapitulate the required mathematical background, to motivate the topic of the lecture,and/or to lay the ground for in-class activities. Depending on the course level, especially the reading assignments are designed as close as possible tothe regular work as a researcher: I try to include research papers in the relevant field whenever possible, and I include small literature research tasks in master-level courses.

During the lectures, I present the lecture content and provide in-class activities that allow the students to apply newly acquired techniques to simple examples, or to discuss and verify important details. To my experience, an optimal concentration curve is achieved by structuring the lectures such that 30 to 45 minutes of lecturing are followed by15 minutes of student activities. I present additional details and relevant problems in tutorial sessions alongside the lectures. To further provide a hands-on experience, I offer numerical block assignments / mini projects in small groups, designed to span a larger thematic block, consisting of, e.g., three lectures. The goal of the group assignment part is to verify and compare the results obtained from simulations using the analytical tools and models provided in the lectures, as well as to learn to operate in teams. With this structure, students learn to implement, analyse, and verify basic modelling methods in complementing ways. I have made good experience with this kind of projects / tutorial sessions. The students receive direct and timely feedback on their level of understanding, and the projects force the students to study deeply the required basics. Since I began my self-responsible teaching, I had access to online teaching portals ("Moodle" at CAU and"Blackboard" at SDU), and I made extensive use of these platforms. From the beginning, I used these platforms for collective announcements and to provide the students with the entity of created and needed material (Slides, lecture notes, assignments, etc.). Furthermore, I commonly offer a central course discussion forum, where enrolled students can discuss, question and share all kinds of course-related matter. The latter is, however, completely voluntary and not related to any kind of assessment so far. This might be changed in future course implementations.

Reflections and improvements

Even though my course design is based on five modules that are designed to activate the students in different ways, I observed that students tend to only actively participate in modules that are directly connected to the final assessment. The final examination consists of an oral exam in which the students analyse typical physics-related modelling problems with the numerical and analytical tools provided in the course. Accordingly, lectures and tutorial sessions are well attended, and even the homework assignments/ mini projects are commonly appreciated. The preparation tasks, however, tend to get less attention, even though some students retrospectively admitted their utility. Since parts of the in-class activities are jointly designed with the preparation tasks,they are affected by this as well. A simple way to improve this and to enhance student involvement might be linking activities to assessment in a stronger way.

A critical point in all lectures turned out to be the presentation speed. Here, it is a huge challenge to mitigate between speed and securing that the content is actually received by audience. I originally carried out the lecturing parts by presenting slides, prepared with LaTeX. In order to keep the students' attention as close as possible to the (verbal) reasoning, I commonly unfold the presented slides step-by-step, exactly following the steps of the argumentation. I usually provide the completely unfolded slides ("handouts") to the students before or after the lecture (depending on the current situation). I complemented the slide- based part by carrying out selected proofs or arguments at the blackboard. Here, the speed is much better matched to the students' note taking speed. On the down side, this switching makes it hard to provide a comprehensive set of lecture notes to the student (or for my own reference), and blackboard writing comes with quite a maintenance overhead. Since I started my first courses at SDU, I try to tackle this problem with digitally handwritten notes: I write the former blackboard part of my lectures on a tablet computer and show it to the students in real time via a classroom projector that is also used to present slides etc. First, this has the advantage that the lecture notes are developed together with the audience, at a reasonable speed. Second, it is possible to quickly change between the notes, slide-based presentation material, and hands-on programming/numerical demonstration. Last but not least, this enables an efficient way of putting together a comprehensive set of lecture material (notes, slides, programming examples) as a combined document. For more details on this matter I refer to my development project report.

During the lecturer training program, I learned about the possibility to employ student response systems for getting online feedback when carrying out student activities during the lectures. Especially in large classes, for me, this turned out to bea splendid tool to activate the vast majority of the audience. I refer to my e-learning project report for more details on this matter.