MST Review Academic Year 2021/22

Alexander W. Koch

Institute for Measurement Systems and Sensor Technology (MST)
Technical University of Munich (TUM)

Theresienstraße 90, 80333 Munich
www.mst.ei.tum.de

Team

Koch, Alexander W., Prof. Dr.-Ing. habil. Dr. h.c., Ordinarius

Jakobi, Martin, Dr.-Ing., Academic Director
Ott, Sabine, Dr.-Ing., Lecturer
Werthschulte, Kay, Prof. Dr.-Ing., Lecturer

Bierbaum, Rainer
von Grafenstein, Rita
Obermaier, Bernhard
Poplawski, Zbigniew

Baier, Valentin, M.Sc. *)
Bian, Qiang, M. Eng.
Brändle (geb. Pöller), Franziska, M.Sc.
Buchfellner, Fabian, M.Sc. *) (since 10 June 2022)
Dong, Jie, M.Sc.
Dong, Xingchen, Dr.-Ing. *)
Dutz, Franz Josef, M.Sc. *) (until 31 December 2021)
Fink, Maximilian, M.Sc.
Haider, Arsalan, M. Eng. *)
Hoffmann, Marcel, Dr.-Ing.
Jiang, Zongze (since 15 October 2021)
Kienitz, Sascha, M.Sc. *)
Kienle, Patrick, Dr.-Ing. (until 30 September 2022)
Kurz, Wolfgang, M.Sc.
Lindner, Markus, M.Sc. *) (until 31 October 2021)
Stadler, Andrea, M.Sc. *)
Stemplinger, Anselm, B. Sc. (since 15 March 2022)
Wang, Kun, M. Eng.
Wang, Shuchao (since 08 January 2022)

*) External cooperation

Teaching and Research in Academic Year 2021/22

Teaching Courses

- Advanced Laboratory Training Course Optomechatronical Measurement Systems
- Basic Laboratory Course Electrical Engineering
- Electrical Measurement of Environmental Quantities
- Electrical Measurement Technology for Computer Scientists
- Electromagnetic Sensors and Measurement Systems Laboratory: Experiment Computer-Generated Holography
- Laboratory Course Measurement and Sensor Technology (teaching profession)
- Measurement Systems and Sensor Technology (MST)
- Measurement Systems and Sensor Technology, TUM Asia, Singapore
- Measurement Systems and Sensor Technology for Mathematicians
- Measurement Systems and Sensor Technology in Mechanical Engineering
- Measurement and Sensor Technology (teaching profession)
- Non-contact Techniques for Material Testing, Athens Course
- Optomechatronical Measurement Systems, TUM Asia, Singapore
- Optomechatronical Measurement Systems (OMS)
- Photonic Measurement Systems (PM)
- Sensor Electronics, TUM Asia, Singapore
- Space Electronics for Sensor Systems

Bachelor Theses

Abdelsalam, Youssef: FPGA-Implementierung einer schnellen Fourier-Transformation und Amplitudenberechnung.

Abdulla, Rosa: Untersuchung der Absorptionseffizienz in Stickstoffdioxid verursacht durch unterschiedliche Lichtquellen der photoakustischen Spektroskopie.

Altunoglu, Melike: Erarbeitung eines Konzeptes zur Identifikation unplausibler Systemabschaltung der Frontradare.

Ceylan, Altan: Redesign and Comparison of a Laser Board with Chip-on-board and full SMD Process.

Chan, Yun Zhong: Sweat Wearable Devices - A review.

Duong, Min Hieu: Characterization of core-offset SMS fiber sensors for temperature and strain sensing.

Hassan Khan, Ali: Hyperspectral Imaging and Single Cell Analysis .

Ho, Zhi Zhong: Sports wearable devices for runners and football players - A review.

Huber, Anna: Evaluation of Fabry Pérot Accelerometers for Condition Monitoring of Wind Turbines.

Kraut, Julius: Untersuchung der Messauflösung des MeoM-PAS bei unterschiedlichen Einflussfaktoren.

Li, Jianqing: Autofocusing of brightfield microscopic images of microbeads by generative adversarial network.

Li, Yibo: Development of a Graphical User Interface to control a Hyperspectral Imaging System.

Liu, Zhaoming: Untersuchung der optimalen Aufteilung der Apertur eines koaxialen LiDAR-Systems in Sende- und Empfangspfad.

Ma, Jiayi: Resnet-Inception with Attention Layer for Multilabel Classification of Microscopic Images of 2D Materials.

Meier, Jonathan: High-Side Lasertreiber für ein Mehrkanal LiDAR System.

Mraihi, Mohamed Nadhem: Investigation of background noise effect on LiDAR performance.

Nettah, Abdellah: Entwicklung eines Messsystems zur Detektion von schwachen Ultraschallquellen über 65 kHz.

Reich, Severin: Opto-Mechanical Design of a Laser-Induced Breakdown Spectrometer for Space Applications.

Schadhauser, Matthias: Optimization of a Smartphone Application for Colorimetric Urine Analysis.

Schauerte, Anton: Weiterentwicklung eines Verfahrens zur Kalibrierung von Gurtkraftsensoren.

Schwald, Florian: Implementierung einer Spiegelungsberechnung in eine generische Rauheitssimulation.

Strambach, Xaver: Optische Messung von thermischer Probenexpansion.

Su, Xingyu: Study of factors affecting the sensitivities of SMS fiber sensors.

Weber, Julius: Aufbau einer neuen photoakustischen Messzelle für die photoakustische Interferometrie.

Yee, Nicholas Shen Fu: Molecular Signatures using Hyperspectral Imaging – A review.

Advanced Seminars

Abdulla, Rosa: Portierung und Verbesserung eines Interfaces in LabVIEW.

Azer Maluf Makhoul, Luiz Felippe: Entwicklung und Aufbau einer Testeinrichtung für Batterie-Management-Systeme bei der BMW AG.

Bektas, Furkan: Projekt SNF: Test & Absicherung des ADCAM Low Sensors.

Cheng, Haoran: Machine Learning for Multi-spectral Microscopy Images Segmentation of 2D Materials.

Han, Xunjie: Konzeption und Realisierung eines Teilsystemplatzes mit einem fusionierten FAS-LOW und FAS-MID Aufbau zum parallelen Absichern der LOW und MID Varianten.

Kahraman, Alize: Development of A Calender Machine for Filter Fabrics.

Li, Jianqing: Some modifications to the custom-built hyperspectral imaging microscope system.

Liu, Linkai: Qualitätskontrolle, Fehleranalyse und Fertigstellung von Stromsensoren.

Naili, Bahaeddine: Radar Detection Software and Testing Engineering Data Analysis.

Reich, Severin: Implementierung eines Interferometers.

Schwald, Florian: Ingenieurspraxis bei ZF Friedrichshafen AG.

Su, Xingyu: Strain-insensitive temperature sensing with SMS fiber sensor.

Engineering Practice

Abdulla, Rosa: Portierung und Verbesserung eines Interfaces in LabVIEW.

Azer Maluf Makhoul, Luiz Felippe: Entwicklung und Aufbau einer Testeinrichtung für Batterie-Management-Systeme bei der BMW AG.

Bektas, Furkan: Projekt SNF: Test & Absicherung des ADCAM Low Sensors.

Cheng, Haoran: Machine Learning for Multi-spectral Microscopy Images Segmentation of 2D Materials.

Han, Xunjie: Konzeption und Realisierung eines Teilsystemplatzes mit einem fusionierten FAS-LOW und FAS-MID Aufbau zum parallelen Absichern der LOW und MID Varianten.

Kahraman, Alize: Development of A Calender Machine for Filter Fabrics.

Li, Jianqing: Some modifications to the custom-built hyperspectral imaging microscope system.

Liu, Linkai: Qualitätskontrolle, Fehleranalyse und Fertigstellung von Stromsensoren.

Naili, Bahaeddine: Radar Detection Software and Testing Engineering Data Analysis.

Reich, Severin: Implementierung eines Interferometers.

Schwald, Florian: Ingenieurspraxis bei ZF Friedrichshafen AG.

Su, Xingyu: Strain-insensitive temperature sensing with SMS fiber sensor.

Research Practice

Bogenberger, Julian: Evaluierung eines Konzepts zur LiDAR-basierten Fußgängerdetektion in Innenräumen.

Colicchia, Ennio: Optimization of a Single Multimode Fiber Imaging System.

Doppelfeld, Christoph: Retrospect on the XGA read-out project.

Hamzaoui, Soumaya: Untersuchung des Einflusses der Temperatur auf die Auslenkung des piezoelektrischen Aktors.

Joglekar, Jyohan: Simulation and validation of Camera sensor under rain condition.

Pohl, Sören: Klassifizierung von Opfern in einem Massenanfall von Verletzten durch künstliche Intelligenz.

Szymczyk, Pawel: Planning and implementation of a cloud-based sensor solution for monitoring the mixing ratios of liquids.

Treutinger, Tim: Single Event Latchup Detection Circuit for a Jetson Xavier NX Embedded Computer.

Interdisciplinary Project for Computer Scientists

Janou, Mhd Karim: Object Classification Based on LIDAR Tracking Data.

Master Theses

Beger, Severin: Automation of the System Identification of a Solid State MEMS Mirror.

Corona, Michele: Modellierung und Evaluierung eines optimierten Empfangssystems für 3DUltraschallsensoren.

Fichtner, Robert: Entwicklung eines Tests zur Bestimmung der maximalen Reichweite eines LiDAR-Systems unter Tageslichteinfluss.

Friedl, Katharina: Design of a Magnetic Field Sensing Concept for the State Estimation of a Nonlinear Oscillating MEMS Mirror.

Fujs, Manuel: Position Classification using Bedding Sensor Textiles: General and Personalized Models.

Gorbatschow, Maxim: Characterization and Optimization of an Optical-Electronical Converter Chip to Measure Fiber Bragg Gratings.

Joglekar, Jyohan: Meta representation and identification of real world critical scenarios and its impact on performance automotive LiDAR sensor and safety of ADAS features in a simulation environment.

Kellner, Valentin: Development of a Laser Driver PCB with Optimized Heat Dissipation.

Leitenberger, Marcel: Dreidimensionale Schwingungsanalyse an berührungslosen Oberflächenmesssystemen.

Li, Fuyuan: Development of a Camera-based System for the Automatic Evaluation of the Customer-oriented Appearance of Vehicle Exterior Light.

Ozkaya, Yasir: Optical Intracranial Sensor for Real Time Monitoring of Neurophysiology.

Pigniczki, Marcell: Modeling of Automotive RADAR and LiDAR Sensors for Virtual Validation.

Qiao, Yi: Deep Fusion Network for Segmentation of Hyperspectral and Optical Microscopic Images.

Shi, Zhuo: 3D CNN for Multispectral Microscopic Imagery Segmentation.

Szymczyk, Pawel: Planung und Weiterentwicklung einer lokalen Flüssigkeitsüberwachung zu einer cloudbasierten Lösung.

Wang, Qi: Multibeam array interferometric microscopy for high-throughput phase imaging.

Zhang, Yucheng: Deep-Learning-Based Autofocusing of Bright-Field Microscopic Imagery.

Zhu, Qiufan: Autofocusing of Multispectral Microscopic Imagery Using Deep Learning.

Doctorates

Dong, Xingchen, Dr.-Ing.: (Exam on 12.11.21) Hyperspectral imaging microscopy for atomic layer mapping of two-dimensional materials
1. Examiner: Prof. Alexander W. Koch
2. Examiner: Prof. Vasilis Ntziachristos

Dutz, Franz Josef, Dr.-Ing.: (Exam on 06.04.22) Faseroptische Multipunkt-Sensornetzwerke zur Messung von Hochtemperaturverteilungen in Gasturbinen und chemischen Reaktoren
1. Examiner: Prof. Alexander W. Koch
2. Examiner: Prof. Johannes Roths, HAW München

Kienle, Patrick, Dr.-Ing.: (Exam on 20.07.22) Hochauflösende optische Abstandsmessung mittels kompensierter Lasertriangulation
1. Examiner: Prof. Alexander W. Koch
2. Examiner: Prof. Félix Salazar Bloise, Universidad Politécnica de Madrid, Spain

Lindner, Markus, Dr.-Ing.: (Exam on 03.11.21) Hochtemperatur-Sensorik mittels regenerierten Faser-Bragg-Gittern im Aluminiumguss
1. Examiner: Prof. Alexander W. Koch
2. Examiner: Prof. Johannes Roths, HAW München

Sorrowful Occasions

- On 22 May 2022, Prof. em. Dr. rer. nat. Dr. h.c. mult. Elmar Schrüfer and on 21 August 2022 Prof. Dr.-Ing. Friedrich Schneider passed away. We always remember both of them very gladly and both of them will remain in our hearts. Please see also TUMcampus, Technical University of Munich, https://mediatum.ub.tum.de/1687397, page 87, September 2022 (Prof. Schrüfer) and also next issue of TUMcampus, 4/2022 or 1/2023 (Prof. Schneider).

Special Events

- Maximilian Fink, M.Sc., received the Pelkhoven Prize on January 24, 2022 for his master's thesis "Readout and Performance Characterization of Silicon Photomultipliers for Time of Flight LiDAR" (from the German Catholic Students Association Aenania, Munich and from "Professor Linhard Studenten-, Heim- und Unterstützungsverein eV") for outstanding academic work.
- From 10-21 January 2022 Prof. Koch presented the lecture and the tutorial lecture “Sensor Electronics” in a digital format for the TUM Asia Bachelor Program “Electronics and Data Engineering” at Singapore Institute of Technology, Singapore.
- From 9-20 May 2022 Prof. Koch presented the lecture and the tutorial lecture “Polymer Electronics” in a digital format in the framework of the master program “Green Electronics”, TUM campus in Singapore, German Institute of Science and Technology, in cooperation with Nanyang Technological University, Singapore.

Funding and Cooperation

- Since 1999 scientific cooperation with the Max Planck Institute for Plasma Physics (IPP), Garching, in the field of surface diagnostics
- Since 2009 cooperation with Klüber Lubrication, Munich, in the field of optical measurement technology
- Since 2012 cooperation with fos4X GmbH/Polytech Wind Power Technology Germany GmbH, Munich, in the field of fiber optical measurement technology
- Since 2017 cooperation with Blickfeld GmbH, Munich, in the field of fiber optical measurement technology
- Since 2020 scientific cooperation with the Imperial College London, UK, in the field of optical measurement technology
- Funding of the project "Development of a high-performance short-range LiDAR system based on multi-laser technology for autonomous vehicles" by the Federal Ministry of Economy and Energy (BMWi) due to a decision of the German Federal Parliament in the program "Central Innovation Program for SMEs (ZIM)" in cooperation with Blickfeld GmbH in the period 01.02.2020-31.10.2022
- Funding of the scholarships of Mr. Kun Wang (01.10.18-30.09.22), Mr. Qiang Bian (01.10.19-30.09.23), Mr. Zongze Jiang (01.10.2021-31.03.2023), and Mr. Shuchao Wang (08.01.2022-07.01.2026) in the field of Optical Metrology, by the Chinese Ministry of Education under its funding organization China Scholarship Council (CSC)

Publications, Patents, and Conferences

Baier, V.; Schardt, M.; Fink, M.; Jakobi, M.; Koch, A.W.: MEMS-Scanner Testbench for High Field of View LiDAR Applications. Sensors 2022 (22), 39, DOI: 10.3390/s22010039, December 2021.

Bian, Q.; Bauer, C.; Stadler, A.; Buchfellner, F.; Jakobi, M.; Volk, W.; Koch, A.W.; Roths, J.: Investigation of Strain Behavior during Aluminum Casting Process with Regenerated Fiber Bragg Grating Arrays. International Conference on Optical Fiber Sensors (OFS27), Alexandria, USA, Aug29-Sept2, 2022.

Bian, Q.; Podhrazsky, A.; Bauer, C.; Stadler, A.; Buchfellner, F.; Kuttler, R.; Jakobi, M.; Volk, W.; Koch, A.W.; Roths, J.: Temperature and external strain sensing with metal-embedded optical fiber sensors for structural health monitoring. Optics Express 30(19), 33449-33464, DOI: 10.1364/OE.459459, August 2022.

Buchfellner, F.; Fiedler, S.; Danalache, M.; Daniel, C.; Bian, Q.; Trautwein, B.; Hofmann, U.K.; Roths, J.: Micro-Indentation on Bovine and Human Cartilage with Phase-shifted Fiber Bragg Gratings in PM Fibers. International Conference on Optical Fiber Sensors , 2022.

Dong, J.; Yetisen, A.K.; Zhao, C.; Dong, X.; Brändle, F.; Wang, Q.; Jakobi, M.; Saur, D.; Koch, A.W.: Single-Shot High-Throughput Phase Imaging with Multibeam Array Interferometric Microscopy. ACS Photonics (2330-4022), DOI: 10.1021/acsphotonics.1c01124, November 2021.

Dong, X.: Hyperspectral imaging microscopy for atomic layer mapping of two-dimensional materials. Shaker-Verlag, 2022.

Dong, X.; Li, H.; Yan, Y.; Cheng, H.; Zhang, H. X.; Zhang, Y.; Le, T. D.; Wang, K.; Dong, J.; Jakobi, M.; Yetisen, A.K.; Koch, A.W.: Deep-Learning-Based Microscopic Imagery Classification, Segmentation, and Detection for the Identification of 2D Semiconductors. Journal Advanced Theory and Simulations, DOI: 10.1002/adts.202200140, July 2022.

Dong, X.; Zhang, Y.; Li, H.; Yan, Y.; Li, J.; Song, J.; Wang, K.; Jakobi, M.; Yetisen, A.K.; Koch, A.W.: Microscopic Image Deblurring by a Generative Adversarial Network for 2D Nanomaterials: Implications for Wafer-Scale Semiconductor Characterization. ACS Applied Nano Materials, 5, 12855−12864, DOI: 10.1021/acsanm.2c02725, September 2022.

Dutz, F.J.: Faseroptische Multipunkt-Sensornetzwerke zur Messung von Hochtemperaturverteilungen in Gasturbinen und chemischen Reaktoren. Dissertation, 2022.

Kienitz, S.; Schmid, M.; Jakobi, M.; Koch, A.W.: Forschung auf dem Gebiet der angewandten faseroptischen Drucksensorik. Annual Magazine Engineering Sciences Germany 2021/22: Measurement and Sensor Technology, Institute for Scientific Publications, November 2021.

Kienitz, S.U.; Staats, M.; Lohr, L.; Irsperger, J.; Schmid, M.J.; Koch, A.W.; Weiss, J.: Fiber optic pressure measurement on a complex outer winglet model with active flow control actuators. Sensors and Actuators A Physical, Volume 332, Part 1, 2021.

Kienle, P.: Hochauflösende optische Abstandsmessung mittels kompensierter Lasertriangulation. Dissertation, 2022.

Lindner, M.: Hochtemperatur-Sensorik mittels regenerierten Faser-Bragg-Gittern im Aluminiumguss. Shaker-Verlag, 2022.

Stadler, A.; Buchfellner, F.; Zeisberger, A.; Jakobi, M.; Koch, A.W.; Roths, J.: Verification of the mechanical integrity of regenerated fiber Bragg gratings (RFBGs) by shaker tests for their use as high-temperature sensors in gas turbines. International Conference on Optical Fiber Sensors (OFS27), Alexandria, USA, Aug29-Sept2, 2022.

Wang, K.; Dong, X.; Kienle, P.; Fink, M.; Kurz, W.; Köhler, M.H.; Jakobi, M.; Koch, A.W.: Optical Fiber Sensor for Temperature and Strain Measurement Based on Multimode Interference and Square-Core Fiber. Micromachines 12(10), 1239, DOI: 10.3390/mi12101239, October 2021.

Wang, K.; Mizuno, Y.; Dong, X.; Kurz, W.; Fink, M.; Jakobi, M.; Koch, A.W.: Strain-insensitive high-sensitivity temperature sensing based on multimode interference in a square-core fiber. Japanese Journal of Applied Physics, DOI: 10.35848/1347-4065/ac74fe, June 2022.

Wang, K.; Mizuno, Y.; Kishizawa, K.; Toyoda, Y.; Lee, H.; Ichige, K.; Dong, X.; Kurz, W.; Jakobi, M.; Koch, A.W.: Accuracy improvement in POF-MMI-based temperature sensing by higher-order mode excitation. 30th International Conference on Plastic Optical Fibers (POF 2022), paper 12, Bilbao, Spain, September 26-28, 2022.

Cover: Impressions from Singapore (Source: Prof. A. W. Koch)
Editing and Layout: Dr. M. Jakobi
Munich, December 2022