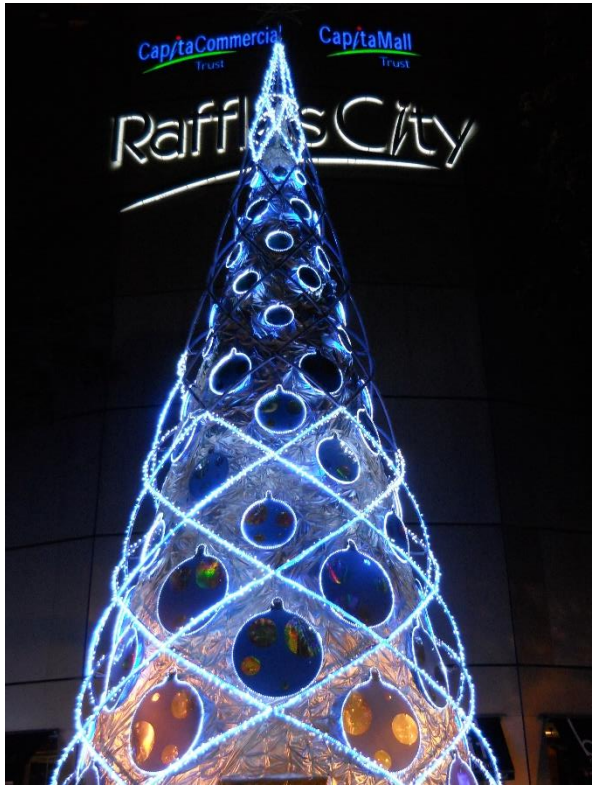
MST Review Academic Year 2020/21



Institute for Measurement Systems and Sensor Technology (MST)
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Team

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Werthschulte, Kay, Prof. Dr.-Ing., Lecturer

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Smetanina, Evgeniya, Dr. (until 20 December 2020)
Stadler, Andrea, M.Sc. *) (since 01 February 2021)
Wang, Kun, M.Eng.

*) External cooperation

Teaching and Research in Academic Year 2020/21

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)
- Space Electronics for Sensor Systems

Bachelor Theses

Balbach, Samira: Smartphone application for colorimetric urinalysis

Bogenberger, Ralf: Entwicklung eines Wahrnehmungssystems auf Basis stationärer Monokameras zur Detektion von Fußgängern

Bürger, Florian: Automatische Bilderkennung in der Produktion faseroptischer Messsysteme im Sinne einer Smart Factory

Erhard, Johann: Filtering of Sparsely Populated Point Clouds Based on 3D Ultrasonic Sensor Data

Fest, Nicholas E.: Filtering of Sparsely Populated Point Clouds Based on 3D Ultrasonic Sensor Data

Flügge Arus, Aron: Aufbau und Evaluation eines Gasteststandes zur Entwicklung einer multiparametrischen Sensorik für die Erhaltung von wertvollem Kulturgut

Flyax, Sergey: Intracranial Sensors for Continuous Monitoring of Neurophysiology

Gamper, David: Stability Research and Characterization of a Laser Triangulation Setup

Haoran, Cheng: Machine-learning-based Multilabel Classification of Microscopic Images of 2D Materials

He, Junnan: UV wearable devices - A review

Hecht, Leon: Camera-Aided LIDAR Pedestrian Perception for Social Distancing Measurements

Husadzic, Nirvana: Evaluierung von Kamerasystemen zur Optimierung und Inbetriebnahme eines statischen FTIR-Spektrometers

Irsperger, Jan: Evaluating Aerodynamic Characteristics of an Airfoil in a Wind Tunnel Using Fiber Optic Fabry-Pérot Pressure Sensors

Kratzer, Roman: Aufbau und Evaluierung eines 3D-Modells eines Sensorkopfs für die depolarisationsbasierte Rauheitsmessung

Larasati, Agnia: Compensation of Temperature Variations on Laser Triangulation Setup Using Regression Analysis

Le, Tien Dat: Deep learning for microscopic images segmentation of 2D materials

Loke, Yi Guang: Simulation of Image Sensor Noise in a Laser Triangulation Setup

Michalak, Markus: Designoptimierung eines Photodiodenverstärkers für ein membranloses optisches Mikrofon

Mura, Roman: Erweiterung und Optimierung der Steuerungssoftware eines Lasertriangulationssystems auf einem Raspberry Pi 4B

Oberthür, Luis: Entwicklung und Installation eines Messerfassungssystems für lineare Wirbelstrombremsen am Rollenprüfstand ATLAS

Renda, Elias: Optimierung des optomechanischen Kompensationsaufbaus eines Lasertriangulationssystems

Tan, Nicholas: Imaging through the multimode fiber with neural networks

Treutinger, Tim: Magnetic Compatibility of CubeSat Power Systems

Vancura, Stefan: Detection of Air Flow Direction with an Array of Fiber-Optic Fabry-Pérot Pressure Sensors

Vo, Thanh My: Modeling and Optimization of Laser Spot Detection in a Laser Triangulation Setup

Wenninger, Ralf: Erhöhung der Empfindlichkeit eines Lasertriangulationsaufbaus mit fluoreszierenden Strukturen

Yan, Yuntian: Machine-learning-based Segmentation (U-Net) of Microscopic Images of 2D Materials

Yang, Jinyu: Simulation of beam propagation of SMS fibres in Matlab using open-source software

Zhang, Hui Xin: Machine Learning for Segmenting Microscopic Imagery of 2D Materials

Advanced Seminars

Blake, Alexander Jordan: Sensing and Limiting of Destructive Single Event Effects

Buna, Alexander: Schadstoffe in Getränkeflaschen und ausgewählte Messmethoden zur Schadstoffanalyse

Fichtner, Robert: Überblick über ausgewählte Messprinzipien der nicht-optischen Abstandsmessung

Leitenberger, Marcel: Abstandsmessung mit interferometrischen Methoden

Linhart, Nico: Aktive Methoden zur optischen Distanzmessung ohne Laser

Misik, Adam: A Survey on Passive Optical Measurement Techniques for Distance Estimation

Netzer, Pascal: Historische Entwicklung, Kategorisierung und Diskussion unterschiedlicher Distanzmesssysteme

Straubinger, Dominik: Stand der Technik von berührenden und nahen berührungslosen Wegsensoren

Voufu, Franck: Photoakustische Tomographie an Böden

Engineering Practice

Ayadi, Sirine: Fault Detection in the Wiring of Sensors in Prototype Vehicles

de Vergara Oberloher, Alberto: Automatisierte Kalibrierung und Verifikation von MetCal Prozeduren

Englhardt, Julian: Entwicklung eines Sensorarrays zur Messung der Luftqualität

Fest, Nicholas: Evaluating Simulative and Experimental Measurements of a Laser Triangulation System Under Thermal Loading

Michalak, Markus: Entwicklung einer Platine zur Leistungssteuerung eines Niveausensors

Renda, Elias: Optimierung des Aufbaus eines Lasertriangulationssystems

Schreiner, Paul: Weiterentwicklung und Anwendung einer Multi-Sensor-Einheit

Research Practice

Beger, Severin: Observability analysis of a highly nonlinear solid state MEMS mirror

Fichtner, Robert: Shaker-Befestigung zur Abschwächung von Magnetischen Feldern für Vibrationstests von LiDAR-Strahlablenkeinheiten

Friedl, Katharina: Proof of Concept for a Highly Dynamical and Accurate Measurement System to Track the Motion of MEMS Mirrors Based on Confocal Distance Measurement

Fujs, Manuel: Evaluation and Calibration of Bedding Sensor Textiles for non-intrusive Measurement of Physiological Parameters

Harder, Samuel: Optimierung des Analog-Front-Ends eines Messsystems für faseroptische Sensorik

Kamm, Lukas: Design and implementation of a measurement setup to determine the optical deflection of an oscillating MEMS mirror

Karl, Sebastian: Optimization of a Control Algorithm by using a CORDIC Co-Processor

Linhart, Nico: Laser Parameter Deviations over Temperature of a LiDAR System

Patriarca, Daniel: Validierung und Optimierung von dynamischen Neigungssensoren

Pigniczki, Marcell: Application of High-Precision FMCW Radars in Hydraulics

Raupach, Andreas: Evaluierung der Einsetzbarkeit eines NIR-Spektrometers zur Qualitätsbeurteilung von Schmierölen

Rückerl, Andreas: Modulentwicklung für eine autonome Echtzeitsteuerung eines schienengebundenen Transportsystems im Maßstab 1:10

Soylemezoglu, Bugra: Interferometer Design

Waffler, Dominik: Implementation of an AI-based driver model for a battery electric vehicle with focus on energy consumption optimization

Wenning, Mario: Charakterisierung der chromatisch-konfokalen Abstandsmessung unter suboptimalen Bedingungen

Interdisciplinary Project for Computer Scientists

Danis, Nehil: Dynamic Background Subtraction and Object Clustering in LiDAR Data

Kirchmair, Lukas: Acceleration of a Point Cloud Viewer of a Next Generation LiDAR with WebAssembly

Layer, Oliver: IoT Interface for Object Recognition Pipelines

Pillmayer, Christoph: Design and Implementation of a Web-Based Point Cloud Viewer for a Next Generation LiDAR

Master Theses

Bao, Shuai: Optimal Path Generation for indirect Teleoperated Driving in urban Environment

Botzner, Andreas: Analog Front-End Design of a Multichannel Photon Detector for LiDAR Applications

Danner, Florian: Multimode Fiber Imaging Using Neural Networks

Dogan, Berk: Measuring LiDAR Range Accuracy with Optical Fibers and Noise Filtering

Gerg, Peter: Planung und Umsetzung einer intelligenten sensorbasierten Temperaturüberwachung von Laboröfen

He, Menghao: Application of High-speed ADCs in LiDAR Signal Processing

Hierl, Michael: Grundlagen der Sensorfusion eines Radar- und eines Bildsensors für Automotive-Anwendungen

Kögl, Felix: Photoakustischer Nachweis von Stickstoffdioxid mit einem membranlosen optischen Mikrofon

Limmer, Johannes: Feasibility Study of Visible Light Communication with a Device Under Test Avoiding Radio Frequency Signals (Rohde&Schwarz)

Schönfeld, Falk: Development of an Automated Hardware-in-the-Loop System Test Bench for LiDAR Sensors

Seitner, Lukas Analog-Front-End Design of an Avalanche Photodiode Based LiDAR Receiver

Wünsche, Sophia: Camera-based Pose Estimation of an Elliptical MEMS Mirror Using a Tip-tilt System

Doctorates

Hoffmann, Marcel Ralf, Dr.-Ing.: (Exam on 08.02.21) Photoakustische Interferometrie zur Gasdetektion.
1. Examiner: Prof. Alexander W. Koch
2. Examiner: Prof. Félix Salazar Bloise, Universidad Politécnica de Madrid, Spanien

Köhler, Michael, Dr.-Ing.: (Exam on 29.06.21) Breitbandige statische Fourier-Transformations-Spektrometer für den mittleren Infrarotbereich
1. Examiner: Prof. Alexander W. Koch
2. Examiner: Prof. Christian Kargel, Universität der Bundeswehr München

Special Events

- In 2020, PolyTech's (Polytech Wind Power Technology Germany GmbH) acquisition of fos4X GmbH, which was successful for both companies, took place to enable PolyTech to better optimize and protect wind turbine rotor blades
- On the IRS 2020, International Radar Symposium, 5-8 October 2020, Warsaw, Poland, Arsalan Haider and his team were awarded the third place in the young scientist contest for their paper "Integration of Phase Noise into a Virtual Test Driving Software to Investigate the Impact on the Radar Performance"
- From 09-20 November 2020 Prof. Koch presented the lecture “Optomechatronical Measurement Systems” in the framework of the master program “Green Electronics” at the German Institute of Science and Technology in cooperation with the Nanyang Technological University, Singapore
- Ms Dr.-Ing. Barbara Hopf was awarded the Professor Hönle Prize of the University of Applied Sciences Munich for her doctoral thesis “Fiber Bragg grating-based multi-parameter measurement for use in high-performance generators” on April 22, 2021
- From 10-21 May 2021 Prof. Koch presented the lecture and the tutorial lecture “Measurement Systems and Sensor Technology” in a digital format for the TUM Asia Master Program “Green Electronics” at Singapore Institute of Technology, 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
- Funding of the DFG research project "In-situ strain measurement during the solidification and the cooling down of aluminium alloys by means of regenerated Fiber Bragg gratings" in cooperation with Professor Roths (University of Applied Sciences Munich) and Professor Volk (TUM - Department of Mechanical Engineering) in the period 01.01.19 - 31.03.21
- Funding of the project "Development of a broadband stationary Fourier-transform infrared spectrometer for the near and middle infrared range with high measuring rates" 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 Comline Elektronik Elektrotechnik GmbH in the period 01.02.17-15.12.20
- Since 2017 cooperation with Blickfeld GmbH, Munich, in the field of fiber optical measurement technology
- Funding of the project "EXIST Transfer of Research: APICBEAM" within the program „Business Start-ups from Science" with funds of the Federal Ministry for Economic Affairs and Energy (BMWi), as well as funds of the European Social Fund for Germany (ESF) in the period 01.09.19-31.12.20 for Daniel Eble, Dr. Sascha Grusche, Christoph Knappe, and Dr. Evgeniya Smetanina
- Funding of the project "iAir – Lab-on-Chip VOC sensor technology" by the German Federal Environmental Foundation (DBU) in cooperation with BioChip Systems GmbH in the period 01.10.19-16.10.20
- 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 01.02.2020-14.02.2022
- Funding of the scholarships of Mr. Jie Dong (01.10.17-30.09.21), Mr. Xingchen Dong (01.10.17-30.09.21), Mr. Kun Wang (01.10.18-30.09.22), Dr. Yubo Huang (13.02.19-09.02.20), Prof. Guoqing Gu (01.12.19-30.11.20), and Qiang Bian (01.10.19-30.09.23) in the field of Optical Metrology, by the Chinese Ministry of Education under its funding organization China Scholarship Council (CSC)

Guests

Gu, Guoqing, Prof., Yancheng Institute of Technology, China, Visiting Scholar, 01.12.19 - 27.11.20

Publications, Patents, and Conferences

Balbach, S.; Jiang, N.; Moreddu, R.; Dong, X.; Kurz, W.; Wang, C.; Dong, J.; Yin, Y.; Butt, H.; Brischwein, M.; Hayden, O.; Jakobi, M.; Tasoglu, S.; Koch, A.W., Yetisen, A.K.: Smartphone-based colorimetric detection system for portable health tracking. Optical Sensors Analytical Methods (13), 2021

Bian, Q.; Bauer, C.; Stadler, A.; Jakobi, M.; Koch, A.W.; Roths, J.: Multipoint temperature monitoring based on a regenerated fiber Bragg grating temperature sensor array in copper casting, Proc. SPIE 11591, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems, 2021

Bian, Q.; Bauer, C.; Stadler, A.; Lindner, M.; Jakobi, M.; Volk, W.; Koch, A.W.; Roths, J.: In-situ High Temperature and Large Strain Monitoring during a Copper Casting Process based on Regenerated Fiber Bragg Grating Sensors. Journal of Lightwave Technology (39 / 20), 2021

Brändle, F.; Salazar Bloise, F.; Jakobi, M.; Dong, J.; Koch, A.W.: Extension and Limits of Depolarization-Fringe Contrast Roughness Method in Sub-Micron Domain. Sensors (21 / 16), 2021

Dong, J.: Vorrichtung zur interferometrischen Mehrstrahl-Array-Mikroskopie. German patent application, 2021

Dong, X.; Li, H.; Jiang, Z.; Grünleitner, T.; Güler, I; Dong, J.; Wang, K.; Köhler, M.H.; Jakobi, M.; Menze, B.H.; Yetisen, A.K.; Sharp, I.D.; Stier, A.V.; Finley, J.J.; Koch, A.W.: 3D Deep Learning Enables Accurate Layer Mapping of 2D Materials. ACS Nano 15 (2), 2021

Dong, X.; Yetisen, A.K.; Dong, J.; Wang, K.; Kienle, P.; Jakobi, M.; Koch, A.W.: Hyperspectral Fingerprints for Atomic Layer Mapping of Two-Dimensional Materials with Single-Layer Accuracy. The Journal of Physical Chemistry C (125(30)), 2021

Haider, A.; Eryildirim, A.; Thumann, M.; Zeh, T.; Schneider, S. A.: Influence of RF Group Delay on the Performance of FMCW Automotive Radar Sensor. IEEE 21st Annual Wireless and Microwave Technology Conference (WAMICON), 2021

Hoffmann, M.: Photoakustische Interferometrie zur Gasdetektion. PhD thesis, TUM, 2021

Jiang, N.; Flyax, S.; Kurz, W.; Jakobi , M.; Tasoglu, S.; Koch, A. W.; Yetisen, A.K.: Intracranial Sensors for Continuous Monitoring of Neurophysiology. Optical Sensors Advanced Materials Technologies (2100339), 2021

Kienitz, S.U.; Lohr, L.; Schmidt, M.J.; Koch, A.W.: Static and Dynamic Pressure Measurement in Flight Test Application With Optical Fabry–Pérot Sensors. IEEE Transactions on Instrumentation and Measurement vol. 70, 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.; Fest, N.E.; Larasati, A.D.; Wang, K.; Köhler, M.H.; Jakobi, M.; W. Koch, A.W.: Analyse eines fehlerkompensierten Lasertriangulationssystems. tm - Technisches Messen 88 (s1), 2021

Köhler, M.: Breitbandige statische Fourier-Transformations-Spektrometer für den mittleren Infrarotbereich. PhD thesis, TUM, 2021.

Köhler, M.H.; Jakobi, M.; Koch, A.W.: Forschung auf dem Gebiet der statischen FTIR-Spektrometer. Annual Magazine Engineering Sciences Germany 2020/21: Measurement and Sensor Technology, Institute for Scientific Publications, pp. 126-128, 2020.

Lindner, M.; Stadler, A.; Hamann, G.; Fischer, B.; Jakobi, M.; Heilmeier, F.; Bauer, C.; Volk, W.; Koch, A.W.; Roths, J.: Fiber Bragg Sensors Embedded in Cast Aluminum Parts: Axial Strain and Temperature Response. Sensors 21 (5), 2021

Pöller, F.; Salazar Bloise F.; Jakobi, M.; Dong, J.; Koch, A.W.: Improvement of Roughness Measurement in Sub-micron Ranges Using Contrast-based Depolarization Field Components. OCM 2021 - Optical Characterization of Materials: Conference Proceedings, 2021

Stadler, A.; Lindner, M.; Bian, Q.; Hamann, G.; Bauer, C.; Volk, W.; Jakobi, M.; Koch, A.W.; Roths, J.: Decoupled temperature and strain measurement with regenerated fiber Bragg gratings during an aluminum casting process, 2021

Wang, K.; Dong, X.; Köhler, M.H.; Kienle, P.; Bian, Q.; Fink, M.; Jakobi, M.; Koch, A.W.: Optical fiber sensors based on multimode interference using square-core fiber for temperature measurement. Proc. SPIE Photonics West, 2021

Wang, K.; Dong, X.; Köhler, M.H.; Kienle, P.; Bian, Q.; Jakobi, M.; Koch, A.W.: Advances in Optical Fiber Sensors Based on Multimode Interference (MMI): A Review. IEEE Sensors Journal 21 (1), 2021

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), 2021

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