





Prof. Dr.-Ing. Jan Zwiener May 12, 1982

jan@zwiener.org • +49 (157) 8988 1398
www.zwiener.org • <http://www.github.com/jnz/>
<https://www.linkedin.com/in/jan-zwiener-984255167/>
Vogesenstr. 11 • 76337 Waldbronn

Darmstadt University of Applied Sciences:
Department of Electrical Engineering and Information Technology (FBEIT)
Birkenweg 8 • 64295 Darmstadt
jan.zwiener@h-da.de • +49 (6151) 533 61016



Curriculum Vitæ

- h_da** Darmstadt University of Applied Sciences (h_da) DARMSTADT
Professor *April 2025 – present*
Professor in the Department of Electrical Engineering and Information Technology. Area of expertise: Advanced Embedded Systems and Flight Control Systems for UAVs.
-  Volocopter GmbH BRUCHSAL
Principal Engineer 2022 – 2025
Lead engineer in the Chief Engineering Team for the Volocopter *VoloCity* eVTOL.
- Head of Flight Control & Navigation** 2016 – 2022
Establishment and management of the department (approx. 20 employees) for the development of multicopter eVTOL flight control and navigation technology. Complete in-house development of the architecture and embedded software. Responsible for the flight control domain. Establishment of a DO-178 development team. Development of a safety-critical robust in-house ADAHRS navigation solution. The flight control system was and is being used in manned and unmanned Volocopter aircraft.
- +HKA** Karlsruhe University of Applied Sciences (HKA) KARLSRUHE
Adjunct Lecturer 2013 – 2025
Independent teaching in the Bachelor's program in Geomatics. Delivering the lecture *Mathematical Models of Sensor Fusion* (6th semester, 2015–2025) and supervising the laboratory course *Geodata Acquisition / Geodatenerfassung 2* (2nd semester, 2013–2014).
-  TU Darmstadt KARLSRUHE/DARMSTADT
Doctoral Researcher / Research Associate 2012 – 2016
Research associate at the Institute for Applied Research (IAF) at Karlsruhe University of Applied Sciences and doctoral candidate at TU Darmstadt. Research and development in navigation and flight control for the Volocopter ZIM project in cooperation with Volocopter GmbH.
- October 2019*
- Award for outstanding achievements from the Verbund der Stifter (Karlsruhe University of Applied Sciences) and the Heinrich Hertz Society for exceptional accomplishments during the doctoral period.
- October 2014*
- Winner of the State Award with the research group *Navka* at the European Satellite Navigation Competition 2014.
-  European Organization for Nuclear Research (CERN) GENEVA, SWITZERLAND
Associated Member of Personnel (Technical Student Programme) 2010 – 2011
Research stay and completion of Bachelor thesis as part of the Technical Student Programme (competitively selected research semester with approx. 80 positions worldwide per selection round).
-  **BOSCH** Robert Bosch GmbH SCHWIEBERDINGEN
Internship Semester (Research & Development) 2009
Complete implementation of a Precise Point Positioning (PPP) software for processing L1 GPS raw data for the navigation of autonomous lawn mowers (MATLAB/C++).
- Studies at Karlsruhe University of Applied Sciences KARLSRUHE
Master of Geomatics (GPA: 1.0 – highest grade on the German scale) 2011 – 2012
Master (M.Sc.) degree in *Geomatics*. Student research assistant in the *Navka* project. Received the award from the *Friends of Karlsruhe University of Applied Sciences* for outstanding academic performance.

Bachelor of Geomatics (GPA: 1.3)

2007 – 2011

Bachelor (B.Sc.) degree in Surveying and Geomatics. Thesis completed at the European Organization for Nuclear Research CERN in Geneva. Received thesis award from *Arbeitskreis Beratende Ingenieure e. V./BDB*.

teXXmo teXXmo GmbH

BÖBLINGEN

System Engineer

2004 – 2007

Development of embedded software for wearable computing solutions (Windows Embedded and Linux).

**BOSCH Akademie für Datenverarbeitung (ADV) & Robert Bosch GmbH** BÖBLINGEN/LEONBERG**State-Certified Computer Scientist**

2001 – 2004

Training at the *Akademie für Datenverarbeitung* in Böblingen in cooperation with Robert Bosch GmbH. Degree: State-Certified Computer Scientist.

Patents

Overview of granted and filed patents:

- **Motor Allocation:** DE102019101903, US11640179B2.
 - **Motor allocation based on actuator characteristics:** US11720124B2, CN112550731B; EP3792184A1.
 - **High integrity flight control architecture:** US11939041B2, CN113401337B; DE102020107172A1.
 - **Control bandwidth adaption based on harmonic oscillations:** EP3819209B1.
 - **Redundant and failsafe FC architecture:** CN114248933B; DE102020124731A1, US2022089274A1.
 - **FC MON deallocation:** US11822330B2, CN113589836B; DE102020111810A1.
 - **Control limit awareness:** DE102023130995.1.
 - **Control of multicopter propulsion units using desired thrust:** EP4279382A1.
 - **Take-off and touchdown detection:** DE 102024103831.4.
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Skills & Continuing Education

Navigation & Sensors: Design and implementation of complete INS and ADAHRS solutions (Error State Navigation Kalman Filter). Development of differential GPS/GNSS solutions and indoor/outdoor pedestrian navigation (sensor fusion, computer vision).

Programming Languages: More than 20 years of in-depth programming experience in C and C++, Python, Assembly (x86, RISC-V, Arm), C#, JavaScript, and Java.

Embedded & Microcontrollers: Development of an embedded RTOS including scheduler (deployed in safety-critical systems such as flight control, battery interface, etc.). ARM development (STM32).

UAV & HIL: Complete in-house development of a multicopter architecture including DO-178 development environment and process introduction.

Machine Learning: Taught fundamentals of neural networks (MLPs) at HKA, practical exercises for a from-scratch custom implementation of a backpropagation algorithm in MATLAB in the Bachelor's program. Certificate of Excellence: Hugging Face Deep Reinforcement Learning Course (2023).

Aviation Standards: Training in ARP4754A (Systems Engineering), ARP4761 (Safety Processes), and DO-178 (up to DAL-A).

Smartphone & Web: Development of the Android app *Wireless IMU* (>100,000 installations). Web development (PHP, MySQL, JavaScript).

Teaching & Supervision: Professor at h_da. Previously: Adjunct lecturer at Karlsruhe University of Applied Sciences, supervision of numerous theses (Bachelor/Master), appointed to the expert committee of the IMM Faculty at HKA (2022).

Selected Projects

A selection of relevant developments and open-source projects:

- **Microsoft Flight Simulator 2020:** Extension of MSFS for the physical simulation of multirotor vehicles (integration of the original Volocopter flight physics, extension of the MSFS 2020 physics engine for multicopters, included in the MSFS 2020 distribution, as of 2025: over **60 million** installations worldwide).
- **nm-pc-multicopter:** State-of-the-art Non-linear Model Predictive Control for multicopters [[GitHub](#)].
- **PyRocketCraft:** Non-linear Model Predictive Control and Neural Network control of a rocket [[GitHub](#)].
- **r5vm:** RISC-V Virtual Machine with GCC/clang support and JIT compiler for x86 hosts [[GitHub](#)].
- **CamTagNavigator:** Camera-based low-cost indoor navigation [[GitHub](#)].
- **cl1norm:** MATLAB/C/C++ library for solving LP problems (L1 Simplex algorithm) [[GitHub](#)].
- **3D Engine:** Open-source release of a 3D engine based on the OpenGL interface for distributed real-time visualization in TCP/IP networks [[GitHub](#)].
- **Q3VM:** Open-source project for a Virtual Machine (VM), written in C, capable of running on microcontrollers [[GitHub](#)].
- **KFCore:** Lightweight, fast, and numerically highly optimized library for Kalman filtering [[GitHub](#)].
- **µdoom:** Port of Doom (1993) to the STM32F7 microcontroller [[GitHub](#)].

Scientific Publications

Publications, conference contributions & theses:

- Zwiener, J.; Stephan, J.; Seiferth, C. (2026): *Real-Time Nonlinear Model Predictive Control of Large Multirotor Aircraft*. IEEE Transactions on Control Systems Technology.
- Doctoral dissertation (Dr.-Ing.): Zwiener, J. (2019): *Robust State Estimation for Navigation and Control of Autonomous and Manned Multicopters with Distributed Sensors*. Publication series of the Geodesy Division, Department of Civil and Environmental Engineering Sciences, Technical University of Darmstadt (Volume 54, ISBN: 978-3-935631-43-3). Also published: Munich 2020 (ISBN: 978-3-7696-5245-1).
- Jäger, R.; Zwiener, J. (2016): *Flight Dynamics, Multi-Sensor Navigation and Control of Scalable Out-/Indoor Multicopter UAVs*. Proceedings of the DVW Seminar UAV 2016, Bonn. ISBN: 978-3-95786-067-5.
- Jäger, R.; Schwenk, J.; Zwiener, J. (2015): *Flight Control and Navigation for scalable and arbitrarily dimensioned UAV and manned multicopters*. 7th German-Brazilian Symposium for Sustainable Development, Heidelberg University.
- Zwiener, J.; Jäger, R. (2015): *Flight Control and Navigation for Scalable and Arbitrarily Dimensioned UAV and Manned Multicopters*. Proceedings of Interexpo-GeoSiberia 2015. ISBN 978-5-87693-803-9.
- Zwiener, J.; Lorenz, A.; Jäger, R. (2014): *Seamless Indoor/Outdoor Navigation with different Custom Low-Cost Foot-Mounted MEMS/GNSS Sensors*. Proceedings Interexpo Geo-Siberia 2014. ISBN: 978-5-87693-715-5.
- Jäger, R.; Diekert, J.; Hoscislowski, A.; Zwiener, J. (2013): *Development and Validation of the Raw Data Simulation Software (SIMA) for Multi-Sensor Navigation Platforms with Emphasis on the Part of GNSS Simulation*. Proceedings of InterExpo-GeoSiberia 2013.
- Jäger, R.; Diekert, J.; Hoscislowski, A.; Zwiener, J. (2013): *Algorithms and System Developments for Navigation and Object Georeferencing*. Internationale Geodätische Woche Obergurgl 2013. ISBN 978-3-87907-526-3.
- Jäger, R.; Zwiener, J. (2012): *High Precision GNSS/MEMS multisensory navigation of UAV including the georeferencing of cameras*. UAVveek 2012, Siegen.
- Jäger, R.; Diekert, J.; Hoscislowski, A.; Zwiener, J. (2012): *SIMA – Raw Data Simulation Software for the Development and Validation of Algorithms for GNSS and MEMS based Multi-Sensor Navigation Platforms*. Proceedings of the FIG Working Week, Rome.
- Diekert, J.; Zwiener, J. (2012): *Multi-Sensor Fusion for Autonomous Navigation and Object Georeferencing*. In: Geomatik aktuell, Vol. 7. ISBN 978-3-890631066.
- Master Thesis: Zwiener, J. (2012): *Design and Implementation of an Algorithm for Quaternion-Based GNSS/MEMS Navigation State Estimation with Deep GNSS Coupling*. Faculty of Geomatics, Karlsruhe University of Applied Sciences.
- Bachelor Thesis: Zwiener, J. (2011): *3-D Integrated Network Adjustment with a Parametric Height Reference Surface*. Faculty of Geomatics, Karlsruhe University of Applied Sciences.

Talks & Presentations

Selection of delivered technical talks and guest lectures:

- 2025: *Volocopter – Urban air mobility* (jointly with Volocopter founder Stephan Wolf). Geodetic Colloquium, University of Stuttgart.
- 2022: *Volocopter – Urban air mobility*. VDI Forum Digital Transformation, Karlsruhe.
- 2021: Keynote speaker at the graduation ceremony for Aerospace Engineering and Geodesy graduates. Neues Schloss, Stuttgart.
- 2018: *Flight Control for Manned Multicopters*. DGLR Workshop (Technical Committee L6.3), TU Berlin.
- 2018: *Volocopter – Manned Multicopter as the Air Taxi of the Future*. Forum Munich Aerospace, TU Munich.
- 2017: *Manned Multicopters*. Conference of Geodesy Students (KonGeoS), KIT Karlsruhe.
- 2016: *Out-/Indoor Navigation Technologies Karlsruhe (NAVKA) – Status Quo and Potentials*. DVW Baden-Württemberg, Karlsruhe.
- 2015: *Algorithm, Software and System Developments for Multi-Sensor Multi-Platform Navigation*. Tübingen Innovation Days (Future Technologies Neckar-Alb).
- 2015: *A Complete Solution for Seamless Autonomous Out/Indoor Navigation*. International Navigation Conference (INC2015), Manchester.
- 2014: *Robust Client/Server Network Engine for 3D Visualization*. Max Planck Institute Tübingen (Prof. Bülthoff).
- 2014: *UAV sensor fusion and control algorithms*. Conference Nocturnal Atmosphere and Laser Ranging, Riga.
- 2013: Interview for TV segment on ZDF about Volocopter.
- 2013: *High Precise GNSS Multisensor Navigation of UAV including the Georeferencing of Cameras and Other Sensors*. UAV-g, Rostock.