



Torsten Kröger (Short Bio)

Dr. Torsten Kröger is a Staff Robotist and the Head of the Robotics Software Division at [Google \[X\]](#). He is also a Visiting Scientist at [Stanford University](#). He received his Master's degree in Electrical Engineering from [TU Braunschweig](#), Germany, in 2002. From 2003 to 2009, he was a research assistant at [Institute for Robotics and Process Informatics](#), from which he received his Doctorate degree in Computer Science in 2009 (summa cum laude).

In 2010, he joined the [Stanford AI Lab](#) as a lecturer and research associate. He has conducted research on autonomous robot systems, real-time trajectory generation, perception, sensor fusion, dynamics, system identification, force/torque control, hybrid switched-system control, safe human-robot interaction, humanoid robots, robot programming paradigms, machine learning, and distributed real-time hard- and software systems.

Torsten has been working as a research consultant for [Volkswagen AG](#), [KUKA Roboter GmbH](#), [Manz Automation AG](#), [Auris Surgical Robotics, Inc.](#), and [Redwood Robotics, Inc.](#)

He is the founder of [Reflexxes GmbH](#), a startup working on research and development of real-time motion generation software. In 2014, Reflexxes was acquired by [Google](#), where Torsten now heads the Robotics Software Division. This includes coordinating robotics and machine learning research activities between [DeepMind](#), [Google Research](#), and [Google \[X\]](#).

Torsten is an editor or an associate editor of multiple IEEE conference proceedings, books, and book series. He received the [2014 IEEE RAS Early Career Award](#), the [2011 Heinrich Büssing Award](#), the [2011 GFFT Award](#), two fellowships of the German Research Association, and he was a finalist of the [2012 IEEE/IFR IERA Award](#) and the [2012 euRobotics TechTransfer Award](#).

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Dr.-Ing. Torsten Kröger
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Personal Information

Born on February 22, 1977 in Rendsburg, Germany, unmarried.

Education

Technische Universität Carolo-Wilhelmina zu Braunschweig, Braunschweig, Germany, 01/2003–04/2009
Dr.-Ing. (summa cum laude), Computer Science, 2009
Dissertation: *On-Line Trajectory Generation in Robotic Systems: Basic Concepts for Instantaneous Reactions to Unforeseen (Sensor) Events*
Advisors: Professor Friedrich M. Wahl and Professor Herman Bruyninckx

Technische Universität Carolo-Wilhelmina zu Braunschweig, Braunschweig, Germany, 10/1997–12/2002
Undergraduate and graduate studies in electrical engineering, prediploma, 1999
Dipl.-Ing. Electrical Engineering, 2002
Thesis: *Development and Verification of a Robot Programming Interface Based on Skill Primitives*

Professional Experience

Google [X], Mountain View, CA, 02/2016–present
Division Head, Robotics Software

Google, Mountain View, CA, 10/2014–02/2016
Group Leader, Robot Control Architectures

Google, Mountain View, CA, 04/2014–10/2014
Robotacist

Stanford University, Stanford, CA, 04/2014–present
Visiting Scientist, *Department of Computer Science, Artificial Intelligence Laboratory*

Stanford University, Stanford, CA, 03/2010–03/2014
Lecturer and Research Associate, *Department of Computer Science, Artificial Intelligence Laboratory*

Reflexxes GmbH, Hamdorf, Germany, 05/2010–03/2014
Founder and CEO (Reflexxes GmbH is now part of Google, Inc.)

Redwood Robotics, Inc., San Francisco, CA, USA, 07/2013–10/2013

R&D Consultant, compliant manipulation

Auris Surgical Robotics, Inc., Redwood City, CA, USA, 06/2012–09/2013

R&D Consultant, medical robots for human eye surgery and endoluminal surgery, haptics

Universität Bremen, Institute of Automation, Bremen, Germany, 02/2013

Offer for a Junior Professorship (W1) (*declined*)

Technische Universität Carolo-Wilhelmina zu Braunschweig, Institute for Robotics and Process Informatics, Braunschweig, Germany, 01/2003–02/2010

Research assistant

KUKA Roboter GmbH, Augsburg, Germany, 09/2009–02/2010

R&D Consultant, real-time motion generation and control

Manz Automation AG, Reutlingen, Germany, 10/2009–12/2009

R&D Consultant, distributed real-time systems

Volkswagen AG, Wolfsburg, Germany, 06/2006–12/2009

R&D Consultant, robot perception and motion planning

Technische Universität Carolo-Wilhelmina zu Braunschweig, Institute of Electronic Components and Circuit Design, Braunschweig, Germany, 10/2001–02/2002

Student teacher

Technische Universität Carolo-Wilhelmina zu Braunschweig, Institute for Robotics and Process Informatics, Braunschweig, Germany, 06/2001–12/2002

Student researcher

Lenze USA, Atlanta, GA, 10/2000–04/2001

Intern

Technische Universität Carolo-Wilhelmina zu Braunschweig, Institute of Electronic Components and Circuit Design, Braunschweig, Germany, 04/2000–07/2000

Student teacher

Peter Wolters AG, Rendsburg, Germany, 06/1997–09/1997

Intern

Awards and Honors

- 2014 IEEE RAS Early Career Award
- 2012 IEEE/IFR Invention and Entrepreneurship in Robotics and Automation Award Finalist

- 2012 euRobotics Technology Transfer Award Finalist
- Heinrich Büssing Award 2011
- GFFT Award 2011 (best dissertation)
- Research Fellowship, Deutsche Forschungsgemeinschaft, 07/2011–06/2012, project title: *Online Trajectory Generation and Multi-sensor Integration in Robot Systems* (KR 2883/4-2)
- Research Fellowship, Deutsche Forschungsgemeinschaft, 03/2010–02/2011, project title: *Online Trajectory Generation and Multi-sensor Integration in Robot Systems* (KR 2883/4-1)

Publications

Monographs

- B01 T. Kröger. *On-Line Trajectory Generation in Robotic Systems: Basic Concepts for Instantaneous Reactions to Unforeseen (Sensor) Events*. Springer Tracts in Advanced Robotics, Vol. 58, **Springer**, January 2010.

Edited Volumes

- E03 T. Kröger (ed.). Multimedia Extension of the **Springer Handbook of Robotics**. **Springer**, Berlin, Heidelberg, Germany, Second Edition, 2016.
- E02 D. Brugali, T. Kroeger, J. Broenink, and B. MacDonald (eds.). Simulation, Modeling, and Programming for Autonomous Robots. **Springer**, Berlin, Heidelberg, Germany, October 2014.
- E01 T. Kröger and F. M. Wahl (eds.). *Advances in Robotics Research*. **Springer**, June 2009.

Refereed Journal Articles and Book Chapters

- J13 W.K. Chung, L.-C. Fu, and T. Kröger. *Motion Control*. In B. Siciliano and O. Khatib, editors, **Springer Handbook of Robotics**, Chapter 8. **Springer**, Berlin, Heidelberg, Germany, Second Edition, 2016.
- J12 F. Flacco, T. Kröger, A. De Luca, and O. Khatib. *A Depth Space Approach for Evaluating Distance to Objects*. *Journal of Intelligent and Robotic Systems*, Special Issue on Cognitive Robotics Systems: Concepts and Applications. **Springer**, Berlin, Heidelberg, Germany, 2014.
- J11 T. Kröger. *On-Line Trajectory Generation: Straight-Line Trajectories*. **IEEE** Trans. on Robotics, Vol. 27, No. 5, pp. 1010–1016, October 2011.
- J10 T. Kröger and F. M. Wahl. *On-Line Trajectory Generation: Basic Concepts for the Instantaneous Reaction to Unforeseen Events*. **IEEE** Trans. on Robotics, Vol. 26, No. 1, pp. 94–111, February 2010.

- J09 T. Kröger, B. Finkemeyer, and F. M. Wahl. *Manipulation Primitives — A Universal Interface Between Sensor-Based Motion Control and Robot Programming*. In D. Schütz and F. M. Wahl. *Robot Systems for Handling and Assembly*. Springer Tracts in Advanced Robotics, **Springer**, 2010.
- J08 B. Finkemeyer, T. Kröger, and F. M. Wahl. *A Middleware for High Speed Distributed Real-Time Communication*. In D. Schütz and F. M. Wahl. *Robot Systems for Handling and Assembly*. Springer Tracts in Advanced Robotics, **Springer**, 2010.
- J07 R. Osypiuk and T. Kröger. *3D Stiffness Actuators for Efficient Force Control Applications*. In D. Schütz and F. M. Wahl. *Robot Systems for Handling and Assembly*. Springer Tracts in Advanced Robotics, **Springer**, 2010.
- J06 R. Osypiuk and T. Kröger. *A Three-Loop Model-Following Control Structure: Theory and Implementation*. *International Journal of Control*, Vol. 83, No. 1, pp. 97–104, January 2010.
- J05 R. Osypiuk and T. Kröger. *A Low-Cost Hexa Platform for Efficient Force Control Systems Using Industrial Manipulators*. *Solid State Phenomena*. Vol. 147–149, pp. 1–6, January 2009.
- J04 T. Kröger, B. Finkemeyer, S. Winkelbach, L.-O. Eble, S. Molkenstruck, and F. M. Wahl. *A Manipulator Plays Jenga*. **IEEE Robotics and Automation Magazine**, Vol. 15, No. 3, pp. 79–84, September 2008.
- J03 T. Kröger, D. Kubus, and F. M. Wahl. *Force and Acceleration Sensor Fusion for Compliant Manipulation Control in Six Degrees of Freedom*. *Advanced Robotics*, Special Issue on Selected Papers from IROS 2006, VSP and Robotics Society of Japan, Vol. 21, No. 14, pp. 1603–1616, November 2007.
- J02 B. Finkemeyer, T. Kröger, and F. M. Wahl. *Executing Assembly Tasks Specified by Manipulation Primitive Nets*. *Advanced Robotics*, VSP and Robotics Society of Japan, Vol. 19, No. 5, pp. 591–611, June 2005.
- J01 B. Finkemeyer, T. Kröger, and F. M. Wahl. *Aktionsprimitive: Ein universelles Roboter-Programmierparadigma*. *at - Automatisierungstechnik*. pp. 189-196, April 2005.

Refereed Conference and Workshop Publications

- C37 J. Mahler, F.T. Pokorny, B. Hou, M. Roderick, M. Laskey, M. Aubry, K. Kohlhoff, T. Kröger, J. Kuffner, and K. Goldberg. *Dex-Net 1.0: A Cloud-Based Network of 3D Objects for Robust Grasp Planning Using a Multi-Armed Bandit Model with Correlated Rewards*. In Proc. of the **IEEE** International Conference on Robotics and Automation, Stockholm, Sweden, May 2016.
- C36 T. Schlegl, T. Kröger, A. Gaschler, O. Khatib, and H. Zangl. *Virtual Whiskers — Highly Responsive Collision Avoidance in Robot Applications*. In Proc. of the **IEEE** International Conference on Intelligent Robots and Systems, pp. 5373–5379, Tokyo, Japan, November 2013.
- C35 R. Katzschmann, T. Kröger, T. Asfour, and O. Khatib. *Towards Online Trajectory Generation Considering Robot Dynamics and Torque Limits*. In Proc. of the **IEEE** International Conference on Intelligent Robots and Systems, pp. 5644–5651, Tokyo, Japan, November 2013.

- C34 A. Gaschler, R.P.A. Petrick, T. Kröger, A. Knoll, and O. Khatib. *Robot Task and Motion Planning with Sets of Convex Polyhedra*. Workshop on *Task and Motion Planning* at Robotics Science and Systems, Berlin, Germany, June 2013.
- C33 A. Gaschler, R.P.A. Petrick, T. Kröger, A. Knoll, and O. Khatib. *Robot Task Planning with Contingencies for Run-time Sensing*. Workshop on *Combining Task and Motion Planning* at the **IEEE** International Conference on Robotics and Automation, Karlsruhe, Germany, May 2013.
- C32 T. Kröger. *Instantaneous Trajectory Generation for Multi-axis Motion Control Systems*. In Proc. of the embedded world Conference, Nuremberg, Germany, February 2013.
- C31 T. Kröger, K. Oslund, T. Jenkins, D. Torczynski, N. Hippenmeyer, R. B. Rusu, and O. Khatib. *JediBot — Experiments in Human-Robot Sword-Fighting*. In Proc. of the International Symposium on Experimental Robotics, Québec City, Canada, June 2012.
- C30 T. Kröger. *On-Line Trajectory Generation: Nonconstant Motion Constraints*. In Proc. of the **IEEE** International Conference on Robotics and Automation, pp. 2048–2054, Saint Paul, MN, USA, May 2012.
- C29 T. Kröger and J. Padiál. *Simple and Robust Visual Servo Control of Robot Arms Using an On-Line Trajectory Generator*. In Proc. of the **IEEE** International Conference on Robotics and Automation, pp. 4862–4869, Saint Paul, MN, USA, May 2012.
- C28 F. Flacco, T. Kröger, A. De Luca, and O. Khatib. *A Depth Space Approach to Human-Robot Collision Avoidance*. In Proc. of the **IEEE** International Conference on Robotics and Automation, pp. 338–345, Saint Paul, MN, USA, May 2012.
- C27 F. Flacco, T. Kröger, A. De Luca, and O. Khatib. *Collision Avoidance in Depth Space*. In Workshop on RGB-D: Advanced Reasoning with Depth Cameras at Robotics Science and Systems, Los Angeles, CA, USA, June 2011.
- C26 T. Kröger and B. Finkemeyer. *Robot Motion Control During Abrupt Switchings Between Manipulation Primitives*. In Workshop on Mobile Manipulation at the **IEEE** International Conference on Robotics and Automation, Shanghai, China, May 2011.
- C25 T. Kröger. *Opening the Door to New Sensor-Based Robot Applications — The Reflexes Motion Libraries*. In Proc. of the **IEEE** International Conference on Robotics and Automation, Shanghai, China, May 2011.
- C24 T. Kröger and F. M. Wahl. *Stabilizing Hybrid Switched Motion Control Systems with an On-Line Trajectory Generator*. In Proc. of the **IEEE** International Conference on Robotics and Automation, pp. 4009–4015, Anchorage, AK, USA, May 2010.
- C23 B. Finkemeyer, T. Kröger, and F. M. Wahl. *The Adaptive Selection Matrix — A Key Component for Sensor-Based Control of Robotic Manipulators*. In Proc. of the **IEEE** International Conference on Robotics and Automation, pp. 3855–3862, Anchorage, AK, USA, May 2010.
- C22 T. Kröger and F. M. Wahl. *Low-Level Control of Robot Manipulators: Sensor-Guided Control and On-Line Trajectory Generation*. Workshop on *Innovative Robot Control Architectures for Demanding (Research) Applications — How to Modify and Enhance Commercial Controllers* at the **IEEE** International Conference on Robotics and Automation, pp. 46–53, Anchorage, AK, USA, May 2010.

- C21 D. Kubus, A. Sommerkorn, T. Kröger, J. Maaß, and F. M. Wahl. *Low-Level Control of Robot Manipulators: Distributed Open Real-Time Control Architectures for Stäubli RX and TX Manipulators*. Workshop on *Innovative Robot Control Architectures for Demanding (Research) Applications — How to Modify and Enhance Commercial Controllers* at the **IEEE** International Conference on Robotics and Automation, pp. 38–45, Anchorage, AK, USA, May 2010.
- C20 T. Kröger and F. M. Wahl. *Multi-Sensor Integration and Sensor Fusion in Industrial Manipulation: Hybrid Switched Control, Trajectory Generation, and Software Development*. In Proc. of the **IEEE** International Conference on Multisensor Fusion and Integration for Intelligent Systems, Seoul, Korea, pp. 411–418, August 2008 (Invited Paper).
- C19 T. Kröger, D. Kubus, and F. M. Wahl. *12D Force and Acceleration Sensing: A Helpful Experience Report on Sensor Characteristics*. In Proc. of the **IEEE** International Conference on Robotics and Automation, Pasadena, USA, pp. 3455–3462, May 2008.
- C18 D. Kubus, T. Kröger, and F. M. Wahl. *Improving Force Control Performance by Computational Elimination of Non-Contact Forces/Torques*. In Proc. of the **IEEE** International Conference on Robotics and Automation, Pasadena, USA, pp. 2617–2622, May 2008.
- C17 D. Kubus, T. Kröger, and F. M. Wahl. *On-Line Estimation of Inertial Parameters Using a Recursive Total Least-Squares Approach*. In Proc. of the **IEEE** International Conference on Intelligent Robots and Systems, Nice, France, pp. 3845–3852, September 2008.
- C16 D. Kubus, T. Kröger, and F. M. Wahl. *On-line Rigid Object Recognition and Pose Estimation Based on Inertial Parameters*. In Proc. of the **IEEE** International Conference on Intelligent Robots and Systems, San Diego, USA, pp. 1402–1408, October 2007.
- C15 B. Finkemeyer, T. Kröger, D. Kubus, M. Olschewski, and F. M. Wahl. *MiRPA: Middleware for Robotic and Process Control Applications*. Workshop on *Measures and Procedures for the Evaluation of Robot Architectures and Middleware* at the **IEEE** International Conference on Intelligent Robots and Systems, San Diego, USA, pp. 76–90, October 2007.
- C14 K. Koenig, V. Schoening und T. Kröger. *Ein transparentes, modulares Kommunikationsframework für die Entwicklung von Software im Automobilbereich*. 8. Symposium zum Thema Automatisierungs-, Assistenzsysteme und eingebettete Systeme für Transportmittel, Braunschweig, pp. 198–218, 2007.
- C13 T. Kröger, D. Kubus, and F. M. Wahl. *6D Force and Acceleration Sensor Fusion for Compliant Manipulation Control*. In Proc. of the **IEEE** International Conference on Intelligent Robots and Systems, Beijing, China, pp. 2626–2631, October 2006.
- C12 T. Kröger, A. Tomiczek, and F. M. Wahl. *Towards On-Line Trajectory Computation*. In Proc. of the **IEEE** International Conference on Intelligent Robots and Systems, Beijing, China, pp. 736–741, October 2006.
- C11 T. Rennekamp, K. Homeier, and T. Kröger. *Distributed Sensing and Prediction of Obstacle Motions for Mobile Robot Motion Planning*. In Proc. of the **IEEE** International Conference on Intelligent Robots and Systems, Beijing, China, pp. 4833–4838, October 2006.
- C10 T. Kröger, B. Finkemeyer, S. Winkelbach, L.-O. Eble, S. Molkenstruck, and F. M. Wahl. *Demonstration of Multi-Sensor Integration in Industrial Manipulation (Poster)*. In Proc. of the **IEEE** International Conference on Robotics and Automation, Orlando, USA, pp. 4282–4284, May 2006.

- C09 T. Kröger, B. Finkemeyer, S. Winkelbach, L.-O. Eble, S. Molkenstruck, and F. M. Wahl. *Demonstration of Multi-Sensor Integration in Industrial Manipulation (Video)*. In Proc. of the **IEEE** International Conference on Robotics and Automation, Orlando, USA, Video-230004, May 2006.
- C08 R. Osypiuk, T. Kröger, B. Finkemeyer, and F. M. Wahl. *A Two-Loop Implicit Force/Position Control Structure, Based on a Simple Linear Model: Theory and Experiment*. In Proc. of the **IEEE** International Conference on Robotics and Automation, Orlando, USA, pp. 2232–2237, May 2006.
- C07 T. Kröger, B. Finkemeyer, U. Thomas, and F. M. Wahl. *Compliant Motion Programming: The Task Frame Formalism Revisited*. In Proc. of the **IEEE** Mechatronics and Robotics, Aachen, Germany, Part III, pp. 1029–1034, September 2004.
- C06 T. Kröger, B. Finkemeyer, M. Heuck, and F. M. Wahl. *Adaptive Implicit Hybrid Force/Pose Control of Industrial Manipulators: Compliant Motion Experiments*. In Proc. of the **IEEE** International Conference on Intelligent Robots and Systems, Sendai, Japan, pp. 816–821, September 2004.
- C05 T. Kröger, B. Finkemeyer, and F. M. Wahl. *Manipulation Primitives as Interface Between Task Programming and Execution*. Workshop on Issues and Approaches to Task Level Control at the **IEEE** International Conference on Intelligent Robots and Systems, Sendai, Japan, September 2004.
- C04 T. Kröger, B. Finkemeyer, and F. M. Wahl. *A Task Frame Formalism for Practical Implementations*. In Proc. of the **IEEE** International Conference on Robotics and Automation, New Orleans, USA, pp. 5218–5223, April 2004.
- C03 U. Thomas, B. Finkemeyer, T. Kröger, and F. M. Wahl. *Error-Tolerant Execution of Complex Robot Tasks Based on Skill Primitives*. In Proc. of the **IEEE** International Conference on Robotics and Automation, Taipei, Taiwan, pp. 3069–3075, September 2003.
- C02 B. Finkemeyer, T. Kröger, and F. M. Wahl. *Placing of Objects in Unknown Environments*. In Proc. of the **IEEE** Methods and Models in Automation and Robotics, Miedzydroje, Poland, pp. 975–980, August 2003.
- C01 K. Diethers, T. Firley, T. Kröger, and U. Thomas. *A New Framework for Task Oriented Sensor Based Robot Programming and Verification*. In Proc. of the **IEEE** International Conference on Advanced Robotics, Coimbra, Portugal, pp. 1208–1214, June 2003.

Exhibits

- X02 T. Kröger, K. Oslund, T. Jenkins, N. Hippenmeyer, D. Torczynski, R.B. Rusu, and O. Khatib. *JediBot — Human-Robot Sword-Fighting*. IEEE International Conference on Intelligent Robots and Systems, San Francisco, CA, USA, September 2011.
- X01 T. Kröger. *Robotersteuerungen der nächsten Generation: Playing Jenga! (Next Generation Robot Control Architectures: Playing Jenga!)*. HANNOVER MESSE, Hannover, Germany, April 2005.

Patents

- P04 T. Kröger. *Generating Robot Trajectories Using a Real Time Trajectory Generator and a Path Optimizer*. USA, 2015.
- P03 T. Kröger and M. Kalakrishnan. *Real Time Robot Implementation of State Machine*. USA, 2015.
- P02 T. Kröger, D. Kubus, and F. M. Wahl. *Positionierende Maschine (Positioning Machine)*. Germany, 2010.
- P01 T. Kröger. *Positionsgesteuerter Mechanismus und Verfahren zur Steuerung von in mehreren Freiheitsgraden beweglichen Mechanismen (Position Controlled Mechanism and Method for Controlling Mechanisms with Multiple Degrees of Freedom)*. Germany, 2008.

Theses

- S03 T. Kröger. *On-Line Trajectory Generation in Robotic Systems: Basic Concepts for Instantaneous Reactions to Unforeseen (Sensor) Events*. Ph.D. thesis. Institute for Robotics and Process Informatics, Carl-Friedrich-Gauß-Fakultät, Technische Universität Carolo-Wilhelmina zu Braunschweig, Mühlenpfordtstraße 23, D-38106 Braunschweig, Germany, April 2009.
- S02 T. Kröger. *Development and Verification of a Robot Programming Interface Based on Skill Primitives*. Diploma thesis (Diplomarbeit). Institute for Robotics and Process Informatics, Carl-Friedrich-Gauß-Fakultät, Technische Universität Carolo-Wilhelmina zu Braunschweig, Mühlenpfordtstraße 23, D-38106 Braunschweig, Germany, December 2002.
- S01 T. Kröger. *Embedding Force Control in a Robot Control System*. Student thesis (Studienarbeit). Institut für elektrische Messtechnik und Grundlagen der Elektrotechnik, Technische Universität Carolo-Wilhelmina zu Braunschweig, Hans-Sommer-Straße 66, D-38106 Braunschweig, Germany, March 2002.

Invited Talks and Colloquia

- T32 T. Kröger. *Hybrid Control of Robot Arms in Task Space Using Real-time Trajectory Generation Algorithms*. Department of Automatic Control, Lund University, Sweden, October 23, 2015.
- T31 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. Faculty of Electrical and Information Engineering, Graz University of Technology, Graz, Austria, June 16, 2014.
- T30 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. The Robotics Institute, Carnegie Mellon University, Pittsburgh, PA, USA, August 2, 2013.
- T29 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. Department of Electrical Engineering, Poznan University of Technology, Poznan, Poland, May 15, 2013.
- T28 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. Department of Computer Science, College of Computing and Informatics, University of North Carolina at Charlotte, Charlotte, NC, April 12, 2013.

- T27 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. Bosch Research and Technology Center North America, Palo Alto, CA, January 4, 2013.
- T26 T. Kröger. *Reflexes Motion Libraries - Highly Reactive Robot Motion Generation*. Department of Automatic Control, Lund University, Sweden, December 21, 2012.
- T25 T. Kröger. *Manipulation Primitives: An Interface between Hybrid Control and Robot Task Specification*. Department of Automatic Control, Lund University, Sweden, December 20, 2012.
- T24 T. Kröger. *Deterministic and Instantaneous Robot Reactions to Sensor and Controller Failures*. Workshop on *Safety in Human-Robot Coexistence and Interaction: How Can Standardization and Research Benefit from each other?* at the **IEEE** International Conference on Intelligent Robots and Systems, Vilamoura, Portugal, October 12, 2012.
- T23 T. Kröger. *Online Trajectory Generation Algorithms as an Intermediate Layer between Robot Motion Planning and Control*. Workshop on *Robot Motion Planning: Online, Reactive, and in Real-time* at the **IEEE** International Conference on Intelligent Robots and Systems, Vilamoura, Portugal, October 12, 2012.
- T22 T. Kröger. *Manipulation Primitives: An Interface between Hybrid Control and Robot Task Specification*. NSF Workshop on Formal Composition of Motion Primitives, Massachusetts Institute of Technology, Cambridge, MA, June 12, 2012.
- T21 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, June 11, 2012.
- T20 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. TU München, Robotics and Embedded Systems Laboratory, Germany, November 7, 2011.
- T19 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. TU Ilmenau, Neuroinformatics and Cognitive Robotics Laboratory, Germany, November 3, 2011.
- T18 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. University of Bielefeld, Neuroinformatics Group, Germany, November 2, 2011.
- T17 T. Kröger. *Menschen und Roboter — Eine (R)evolutionsgeschichte*. TU Braunschweig, Carl-Friedrich-Gauß-Fakultät, Germany, October 14, 2011.
- T16 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. Hong-Kong University of Science and Technology, Automation Technology Center, Germany, May 16, 2011.
- T15 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. TU Berlin, Dept. of Computer Engineering and Microelectronics, Germany, April 1, 2011.
- T14 T. Kröger. *On-Line Trajectory Generation in Robotic Systems*. Willow Garage, Menlo Park, CA, USA, January 11, 2011.
- T13 T. Kröger. *Highly Reactive Robot Motion Generation and Control*. University of Freiburg, Department of Computer Science, Germany, November 11, 2010.
- T12 T. Kröger. *MiRPA — Middleware for Robotics and Process Informatics Applications*. University of Pisa, Interdepartmental Research Center “E. Piaggio”, Italy, July 17, 2009.

- T11 T. Kröger. *Current Research Projects at the Institute for Robotics and Process Informatics*. City University of Hong Kong, Department of Manufacturing Engineering and Engineering Management, Hong Kong, August 18, 2008.
- T10 T. Kröger. *Wie ein Industrieroboter Jenga spielt... (How an Industrial Robot Plays Jenga ...)*. Technische Universität Braunschweig, Haus der Wissenschaft, Braunschweig, Germany, April 1, 2008.
- T09 D. Kubus, T. Kröger, and F. Wahl. *Echtzeitbetriebssysteme — Ein Überblick über verschiedene Architekturen (Real-Time Operating Systems — An Overview of Several Architectures)*. ERIG Workshop, Braunschweig, Germany, January 2008.
- T08 T. Kröger. *MiRPA — Middleware for Robotics and Process Informatics Applications*. Technische Universität Braunschweig, Carl-Friedrich-Gauß-Fakultät, Braunschweig, Germany, January 16, 2008.
- T07 T. Kröger. *MiRPA — Middleware for Robotics and Process Informatics Applications*. RoSta Expert Meeting (Robot Standards and Reference Architectures), Leuven, Belgium, November 19, 2007.
- T06 T. Kröger. *Hard- and Software Architecture for the Execution of Manipulation Primitives*. Stanford University, Department of Computer Science, Artificial Intelligence Laboratory, Stanford, USA, May 23, 2006.
- T05 T. Kröger. *Hard- and Software Architecture for the Execution of Manipulation Primitives*. Katholieke Universiteit Leuven, Department of Mechanical Engineering, Division of Production Engineering, Machine Design, and Automation (PMA), Leuven, Belgium, November 7, 2005.
- T04 T. Kröger, B. Finkemeyer und F. M. Wahl. *Hard- und Softwarearchitektur zur Ausführung von Aktionsprimitiven (Hard- and Software Architecture for the Execution of Manipulation Primitives)*. VDE/VDI GMA-Fachausschuss 4.13, Frankfurt, Germany, July 13, 2005.
- T03 T. Kröger. *Current Research Projects at the Institute for Robotics and Process Informatics*. City University of Hong Kong, Department of Manufacturing Engineering and Engineering Management, Hong Kong, September 22, 2003.
- T02 T. Kröger. *Fehlertolerante Ausführung von RoboterMontageaufgaben auf der Basis von Aktionsprimitiven (Error-Tolerant Execution of Robot Assembly Tasks by Using Manipulation Primitives)*. VDE/VDI GMA-Fachausschuss 4.13, Frankfurt, Germany, July 16, 2003.
- T01 T. Kröger. *About Skill Primitives and Other Objectives of the Institute for Robotics and Process Informatics*. IDMEC/IST — Instituto Superior Técnico Technical University of Lisbon, Control, Automation, and Robotics Group, Lisboa, Portugal, July 4, 2003.

Research Grants

- 09/2013–08/2014, project title: *SupraPed — Biped Robot Support Expansions for Rough Terrains*. Sponsor: National Science Foundation, USA (US\$ 100K for own research)
- 07/2013–06/2014, project title: *Robot Physics Engines*. Sponsor: KUKA Laboratories GmbH, Germany (€468K, €168K for own research)
- 04/2012–12/2014, project title: *The Red Sea Robotics Exploratorium*. Sponsor: King Abdullah University of Science & Technology, Saudi Arabia (US\$ 3.2M, US\$ 900K for own research)

- 09/2010–08/2012, project title: *Advanced Manipulation Capabilities for Humanoid Robots*. Sponsor: Honda Motor Co., Ltd., Japan (US\$ 1.3M, US\$ 240K for own research)

Press and Media (Selection)

- May 7, 2013, **Die WELT**: [Wichtigste Robotik-Konferenz eröffnet](#)
- Dec. 13, 2011, **The History Channel**: The Universe (Special Issue on AI)
- Oct. 13, 2011, **IEEE Spectrum**: [Robot Masters Jenga, Next the World](#)
- Oct. 10, 2011, **IEEE Spectrum**: [How JediBot Got Its Sword Fighting Skills](#)
- Oct. 7, 2011, **VDI Nachrichten**: [Sehnsüchtiges Warten auf serienreife Service-Roboter](#)
- Sep. 14, 2011, **Süddeutsche Zeitung**: [Duell mit einem Roboter](#)
- Sep. 9, 2011, **The Electric Playground**: [JediBot](#)
- Jul. 21, 2011, **SPIEGEL Online**: [Roboter schwingen Schwerter und Bratenwender](#)
- Jul. 20, 2011, **WIRED**: [Stanford's Lightsaber-Wielding Robot Is Strong With the Force](#)
- Jul. 19, 2011, **Handelsblatt**: [Jedibot kämpft mit dem Lichtschwert](#)
- Jul. 18, 2011, **IEEE Spectrum**: [Stanford's 'JediBot' Tries to Kill You With a Foam Sword](#)
- Jun. 11, 2009, **Braunschweiger Zeitung**: [Feinfühligler Roboter liebt das Klötzchenspiel Jenga](#)
- Apr. 9, 2005, **Braunschweiger Zeitung**: [Wenn Roboter ein bisschen schlauer werden](#)

Professional Memberships

- IEEE Robotics and Automation Society
- IEEE Technical Committee on Algorithms for Planning and Control of Robot Motion
- IEEE Technical Committee on Software Engineering for Robotics and Automation

Professional Activities

Workshops and Tutorials

- 2015 Tutorial on *Planning, Control, and Sensing for Safe Human-Robot Interaction*, Seattle, WA, USA (Co-organizer)
- 2014 Workshop on *Real-time Motion Generation and Control — Constraint-based Robot Programming*, Chicago, IL, USA (Co-organizer)
- 2014 Workshop on *Next-Generation Robotics: Academia, Start-ups and Industry*, Berkeley, CA, USA (Co-organizer)

- 2013 Tutorial on *The Reflexes Motion Libraries — An Introduction to Instantaneous Trajectory Generation*, Karlsruhe, Germany (Organizer)
- 2012 Workshop on *Robot Motion Planning: Online, Reactive, and in Real-time*, Villamoura, Portugal (Co-organizer)

Conference Organization

- 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems, Vancouver, Canada (IT Chair)
- 2016 IEEE International Conference on Simulation, Modeling, and Programming for Autonomous Robots, Stanford, CA, USA (General Chair)
- 2016 IEEE/RSJ International Conference on Intelligent Robots and Systems, Daejeon, South Korea (Industry Session Co-chair)
- 2015 IEEE/RSJ International Conference on Intelligent Robots and Systems, Hamburg, Germany (Exhibitions Co-chair)
- 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems, Chicago, IL, USA (Information Technology Chair)
- 2014 IEEE Workshop on Advanced Robotics and its Social Impacts, Evanston, IL, USA (Publicity Chair)
- 2011 IEEE/RSJ International Conference on Intelligent Robots and Systems, San Francisco, CA, USA (Local Arrangements Chair)
- 2011 IEEE International Conference on Robotics and Automation, Shanghai, China (Workshops and Tutorials Co-chair)
- 2009 German Workshop on Robotics, Braunschweig, Germany (Co-organizer)

Industry Forums

- 2014 IEEE RAS Industry Forum: *“Perspectives on Entrepreneurship in Robotics and Automation”*, Chicago, IL, USA (Co-organizer)
- 2013 IEEE RAS Industry Forum: *“Where does Entrepreneurship fit in within Industry and Academia?”*, Tokyo, Japan (Co-organizer)
- 2012 IEEE RAS Industry Forum, Vilamoura, Portugal (Co-organizer)

Positions in the IEEE Robotics and Automation Society

Secretary of the IEEE Robotics and Automation Society, 2016–present

Associate Vice-president of the IEEE Robotics and Automation Society Conference Activities Board, 2014–present

Member of the [IEEE Robotics and Automation Society Technical Activities Board](#), 2012–present

Member of the [IEEE Robotics and Automation Society Industrial Activities Board](#), 2012–2015

Member of the [IEEE Robotics and Automation Society Electronic Products and Services Board](#), 2014–2015

Member of the [IEEE Robotics and Automation Society Awards Evaluation Committee](#), 2014–present

Referee

European Commission

Deutsche Forschungsgemeinschaft

National Science Foundation

IEEE Robotics and Automation Society

Springer Tracts on Advanced Robotics (STAR)

Other Editorial Activities

- [Frontiers in Robotics and AI — Robotic Control Systems](#) (Editor)
- [Lecture Notes in Electrical Engineering \(LNEE\)](#) (Editor)

Program Committee Member

2016 International Workshop on the Algorithmic Foundations of Robotics

2016 IEEE International Conference on Robotics and Automation (Associate Editor)

2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (Editor)

2016 IEEE International Conference on Robotics and Automation (Associate Editor)

2016 International Conference on Sensor Networks

2015 IEEE/RSJ International Conference on Intelligent Robots and Systems (Editor)

2015 IEEE International Conference on Robotics and Automation (Associate Editor)

2015 International Conference on Sensor Networks

2014 Robotics Science and Systems

2014 International Conference on Simulation, Modeling, and Programming for Autonomous Robots (Program Co-chair)

2014 IEEE/RSJ International Conference on Intelligent Robots and Systems (Associate Editor)

2014 IEEE International Conference on Robotics and Automation (Associate Editor)
2014 Annual German Conference on Artificial Intelligence
2014 International Conference on Sensor Networks
2013 IEEE Workshop on Advanced Robotics and its Social Impacts (Associate Editor)
2013 Robotics Science and Systems
2013 IEEE/RSJ International Conference on Intelligent Robots and Systems (Associate Editor)
2013 International Conference on Sensor Networks
2013 Workshop on Design, Modeling and Evaluation of Cyber Physical Systems
2013 Annual German Conference on Artificial Intelligence
2012 IEEE/RSJ International Conference on Intelligent Robots and Systems (Associate Editor)
2012 Annual German Conference on Artificial Intelligence
2012 MidSens
2012 Robotics Science and Systems
2011 Annual German Conference on Artificial Intelligence
2011 MidSens

External Reviewer for Journals

IEEE Transactions on Robotics (9)
IEEE Transactions on Control Systems Technology (8)
IEEE RAS Letters (4)
IEEE Transactions on Robotics and Automation (2)
IEEE Robotics and Automation Magazine (2)
IEEE Transactions on Mechatronics (1)
IEEE Transactions on Industrial Informatics (1)
International Journal of Robotics Research (5)
Journal of Intelligent and Robotic Systems (7)
International Journal of Control (2)
Robotica (3)
Journal of Robotics and Autonomous Systems (1)
Journal of Software Engineering for Robotics (1)

ASME Journal of Mechanisms and Robotics (1)

Autonomous Robots (1)

Mechanical Sciences (1)

External Reviewer for Conferences

2016 IEEE International Conference on Robotics and Automation (1)

2015 IEEE/RSJ International Conference on Intelligent Robots and Systems (2)

2015 IEEE International Conference on Robotics and Automation (1)

2014 IEEE/RSJ International Conference on Intelligent Robots and Systems (3)

2014 IEEE International Conference on Robotics and Automation (4)

2013 IEEE/RSJ International Conference on Intelligent Robots and Systems (1)

2013 IEEE International Conference on Robotics and Automation (6)

2013 IEEE International Workshop on Robot Motion and Control (3)

2013 IEEE International Conference on Decision and Control (1)

2013 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (1)

2013 Annual German Conference on Artificial Intelligence (3)

2012 Annual German Conference on Artificial Intelligence (2)

2012 IEEE/RSJ International Conference on Intelligent Robots and Systems (2)

2012 IEEE International Conference on Robotics and Automation (4)

2012 Advances in Robot Kinematics (1)

2011 IEEE/RSJ International Conference on Intelligent Robots and Systems (4)

2011 IEEE International Conference on Robotics and Automation (4)

2011 Annual German Conference on Artificial Intelligence (2)

2011 World Congress in Mechanism and Machine Science (2)

2010 IEEE/RSJ International Conference on Intelligent Robots and Systems (3)

2010 IEEE Conference on Automation Science and Engineering (1)

2010 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (1)

2010 Annual German Conference on Artificial Intelligence (1)

2010 IEEE International Conference on Robotics and Automation (4)

2009 German Workshop on Robotics (3)

- 2009 IEEE/RSJ International Conference on Intelligent Robots and Systems (1)
2009 IEEE International Conference on Robotics and Automation (3)
2008 International Conference on Mechatronics and Machine Vision in Practice (1)
Robotik 2008 (3)
2008 IEEE/RSJ International Conference on Intelligent Robots and Systems (3)
2008 IEEE International Conference on Robotics and Automation (1)
2007 IEEE/RSJ International Conference on Intelligent Robots and Systems (2)
2007 IEEE International Conference on Robotics and Automation (1)
2007 World Congress in Mechanism and Machine Science (5)
2006 International Symposium on Robotics (2)
2006 IEEE/RSJ International Conference on Intelligent Robots and Systems (2)
2006 International IFAC Symposium on Robot Control (1)
Robotik 2006 (2)
2006 International Conference on Rotor Dynamics (1)
2005 IEEE/RSJ International Conference on Intelligent Robots and Systems (1)
2004 IEEE/RSJ International Conference on Intelligent Robots and Systems (1)
2004 IEEE Conference on Mechatronics and Machine Vision in Practice (1)
Robotik 2004 (2)
2004 IASTED International Conference on Robotics and Application (1)
2003 IASTED Conference on Computer Science and Technology (1)
2003 International IFAC Symposium on Robot Control (1)
2003 International Conference on Field and Service Robotics (1)

Ph.D. Students

- Xiyang Yeh (Stanford University, USA)
Gerald Brantner (Stanford University, USA)
Eduardo Moreno (Stanford University, USA)
Jinsung Kwon (Stanford University, USA)
Thomas Schlegl (TU Graz, Austria)
Andreas Stolt (Lund University, Sweden)

Fabrizio Flacco (Sapienza University of Rome, Italy)

Master and Diploma Students

Andreas Krause (TU Braunschweig)

Markus Heuck (TU Braunschweig)

Jochen Maaß (TU Braunschweig)

Stefan Grubic (TU Braunschweig)

Constanze Schidda (TU Braunschweig)

Markus Olschewski (TU Braunschweig)

Sven Molkenstruck (TU Braunschweig)

Matthias Brukner (TU Braunschweig)

Adam Tomiczek (TU Braunschweig)

Alexander Peters (TU Braunschweig)

Christian Hurnaus (TU Braunschweig)

Daniel Kubus (TU Braunschweig)

Michaela Hanisch (TU Braunschweig)

Lars-Oliver Eble (TU Braunschweig)

Shaoqing Xiang (Stanford University)

Vincent Vidal (École nationale supérieure d'arts et métiers, Paris)

Robert Katzschmann (Karlsruhe Institute of Technology)

Brian Soe (Stanford University)

Florian Walter (TU Munich)

Fabian Gerlinghaus (TU Munich)

Teaching Experience

Course Title	Level	Terms
Electrical Networks Theory and Analysis <i>Teaching assistant at TU Braunschweig</i> <ul style="list-style-type: none"> • Graph theory • System modeling • Linear time-invariant systems • Laplace transformation • Transfer functions • Tableau of network equations • Stability • Operational amplifiers • Analysis of nonlinear systems 	Undergraduate	W'01, W'02, S'02
Process Informatics <i>Teaching assistant at TU Braunschweig</i> <ul style="list-style-type: none"> • Introduction • Real-time operating systems • Concurrent processing • Process modeling • Petri Nets • Programming languages for Process Informatics • Distributed real-time communication • Safety and Reliability • Control Engineering for Computer Scientists 	Graduate	S'03 – S'08
Control Engineering for Computer Scientists <i>Lecturer at TU Braunschweig</i> <ul style="list-style-type: none"> • Introduction • Description and modeling of dynamic systems • Fourier transformation • Laplace transformation • Basic elements of control schemes • Transfer functions of control loops • Controller design for continuous systems • Discrete systems • Z-transformation • Controller design for discrete systems • Implementation of control algorithms 	Graduate	S'07 – S'09

Course Title	Level	Terms
CS223-A, Introduction to Robotics <i>Lecturer at Stanford University</i> <ul style="list-style-type: none">• Introduction• Kinematics• Haptics• Inverse kinematics• Trajectory generation• Jacobians• Vision• Dynamics• Control	Graduate	W'12 – W'16
CS225-A, Experimental Robotics <i>Lecturer at Stanford University</i> <ul style="list-style-type: none">• Introduction• Simulation and control software• Identification• Operational space control• Splines• Velocity saturation and trajectory generation• Obstacle avoidance• Potential fields• Singularity avoidance	Graduate	S'12, S'13