

CURRICULUM VITAE

DR.-ING. RENATE SACHSE

Day of Birth December 9th, 1989 in Stuttgart
Children One child, born June 2022
E-mail renete.sachse@tum.de
 sachse@seas.harvard.edu
Scientific Profiles [Google Scholar](#)
 [Scopus](#)
 [ResearchGate](#)



Current Affiliations	Chair of Structural Analysis Technical University of Munich Arcisstraße 21 80333 München	Harvard John A. Paulson School of Engineering and Applied Sciences Harvard University 29 Oxford St Cambridge, MA 02138, USA
----------------------	---------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------

PROFESSIONAL EXPERIENCE

from 05/2024 **Research associate (postdoc)** at the Chair of Structural Analysis, Technical University of Munich directed by Prof. Dr.-Ing. Kai-Uwe Bletzinger

from 07/2023 **Associate** of the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS), Harvard University, Cambridge, USA

01/2021 – 04/2024 **Research associate (postdoc)** at the Institute for Computational Mechanics, Technical University of Munich directed by Prof. Dr.-Ing. Wolfgang A. Wall (*approximately 12 months parental leave*)

04/2023 – 06/2023 **Postdoctoral fellow** in the Bertoldi Lab at Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS), Harvard University directed by Prof. Katia Bertoldi

(04/2020 – 06/2020) **Acceptance as visiting student research collaborator** at Princeton University, New Jersey, USA (*cancelled mid-March due to COVID-19*)

01/2015 – 12/2020 **Research associate** at the Institute for Structural Mechanics, University of Stuttgart directed by Prof. Dr.-Ing. habil. Manfred Bischoff

04/2014 – 07/2014 **Research assistant** at the Institute for Structural Mechanics, University of Stuttgart

11/2012 – 12/2013 **Working student** in structural engineering at Werner Sobek AG, Stuttgart

09/2011 – 12/2011 **Intern** in structural engineering at Foster + Partners, London, UK

02/2011 – 08/2011 **Research assistant** at the Institute for Structural Mechanics, University of Stuttgart

05/2009 – 12/2010 **Working student** in structural engineering at Werner Sobek AG, Stuttgart

EDUCATION

- 10/2020 **Ph. D. in Civil Engineering (Dr.-Ing.)** at the Institute for Structural Mechanics, University of Stuttgart
Title of the thesis: "Variational Motion Design for Adaptive Structures"
Grade: 1.0 with distinction (summa cum laude)
Committee: Prof. Dr.-Ing. habil. Manfred Bischoff, Prof. Dr.-Ing. Kai-Uwe Bletzinger
- 10/2011 – 10/2014 **M. Sc. in Civil Engineering**, University of Stuttgart, *Grade: 1.2 (with distinction)*
Thesis: "Isogeometric Contact Analysis of Thin-Walled Structures"
- 01/2012 – 05/2012 **Study abroad in the ERASMUS-Program**, École Spéciale des Travaux Public, du Batiment et de l'Industrie (ESTP) in Cachan, France
- 10/2008 – 09/2011 **B. Sc. in Civil Engineering**, University of Stuttgart, *Grade: 1.4*
Thesis: "An Elementary School Pavilion for Magagula in South Africa – Structural Analysis"
- 07/2008 **Abitur**, Hegel-Gymnasium Stuttgart, *Grade: 1.5*

GRANTS AND AWARDS

- 10/2023 Appointment as **TUM Researcher within CareerDesign@TUM** – a program for high-potential young researchers at the Technical University of Munich with leadership training
- 08/2023 Admission into the **Freiburg Rising Stars Academy** – a platform for connecting highly qualified international early career researchers to Freiburg scientists
- 07/2022 **Publication Award 2020** of the Faculty 2 (Civil and Environmental Engineering) of the University of Stuttgart for the publication "Snapping Mechanics of the Venus flytrap" in *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*
- 06/2022 **Bertha Benz Prize 2022** of the Daimler and Benz Foundation for female engineering scientists who have achieved added value for society with their dissertation and honoring pioneering spirit, courage and visionary character
- 03/2022 **Klaus Tschira Boost Fund Fellowship** for excellent researchers with a flexible funding of 80,000 € for an independent, higher risk, interdisciplinary project in an early career stage
- 11/2021 **3rd place of the Dr. Wilhelmy-VDI Award** for young female scientists in engineering sciences for an outstanding dissertation with a high significance for science and Germany as a location for technology
- 07/2021 **Award of the Friends of the University of Stuttgart** for special scientific achievements in the dissertation
- 01/2020 – 12/2022 **GAMM Juniors Fellowship** of the Association of Applied Mathematics and Mechanics (GAMM) for excellent junior scientists – limited to three years
- 09/2017 **3rd place at the AVK-Prize for Innovations 2017** for the submission of "Flectofold – ein bionisches, gelenkloses Verschattungssystem" (translated: Flectofold – a biomimetic, hingeless shading system)
- 10/2014 **Emil Mörsch Study Award** for exceptional academic achievements

- 10/2013 – 09/2014 **Scholarship of the German Federal Ministry of Education and Research** (Deutschlandstipendium) for talented and high-performing students
- 10/2009 – 09/2011 **Exemption from tuition fees** for outstanding academic achievements (for the top 5% of students in the academic year)
- 10/2008 – 09/2009 **Exemption from tuition fees** due to well above-average aptitude (for the top 5% of students in the academic year)

VOLUNTARY ACTIVITIES

- 11/2020 – 07/2022 Active member at Ingenieure ohne Grenzen (Engineers without borders), Regional Group Munich - Participation in the internal management (project organization and general administration) and public relations

RESPONSIBILITIES IN UNIVERSITY AND ACADEMICS

- from 09/2023 Elected as representative of the German Association for Computational Mechanics (GACM) in the Young Investigators Committee of the European Community on Computational Methods in Applied Sciences (ECCOMAS)
- 07/2021 – 04/2023 Initiation and organization of the mailing list “young-academics-in-gamm” with information from and for junior scientists (summer schools, workshops, job offers, etc.) with over 200 subscriptions
- 01/2021 – 04/2023 Elected member in the Committee for Equality of the Association of Applied Mathematics and Mechanics (GAMM)
- 11/2019 – 12/2020 Founder and board member of the GAMM Student Chapter at the University of Stuttgart, with over 70 doctoral students in mechanics and applied mathematics
- 10/2019 – 12/2020 Elected representative of the doctoral candidates in the faculty council of the Faculty 2 (Civil and Environmental Engineering) of the University of Stuttgart
- 01/2015 – 12/2019 Organization and support of the student exchange between the University of Stuttgart and the University of Calgary

TEACHING

Numerische Methoden für Ingenieure (Numerical methods for engineers),
Technical University of Munich

Nichtlineare Kontinuumsmechanik (Nonlinear continuum mechanics),
Technical University of Munich

Nichtlineare Finite-Element-Methoden (Nonlinear finite element methods),
Technical University of Munich

Baustatik und Baudynamik I (Structural statics and dynamics I),
University of Stuttgart

Baustatik und Baudynamik II (Structural statics and dynamics II),
University of Stuttgart

Nichtlineare finite Elemente (Nonlinear finite elements),
University of Stuttgart

MEMBERSHIPS IN ACADEMIC ASSOCIATIONS

Member of the German Association for Computational Mechanics (GACM)

Member of the Association of Applied Mathematics and Mechanics (GAMM, "Gesellschaft für Angewandte Mathematik und Mechanik")

Member of the International Association for Computational Mechanics (IACM)

REVIEWER FOR SCIENTIFIC JOURNALS

Advanced Science, Wiley

Frontiers in Robotics and AI, Frontiers

Mechanisms and Machine Theory, Elsevier

SELECTED PRESENTATIONS AT SCIENTIFIC EVENTS

R. SACHSE. Computational mechanics for plant-inspired soft robotics. *Invited talk at the Max-Planck-Institute for Intelligent Systems, Stuttgart, Germany, May 7, 2024*

R. SACHSE, M. WERMELINK, F. TAUBER, T. SPECK. Computational mechanics for plant-inspired soft robotics. *Freiburg Rising Stars Conference, Freiburg, Germany, March 15, 2024*

Y. YANG, R. SACHSE. Multistable inflatables. *Lecture within the research seminar of the Bertoldi Lab, Harvard University, Cambridge, USA, June 8, 2023*

R. SACHSE. Motion design for flexible structures. *Guest lecture within the research seminar of the Bertoldi Lab, Harvard University, Cambridge, USA, April 13, 2023*

R. SACHSE. Motion Design für optimale Bewegungen flexibler Strukturen. *Guest lecture within the research colloquium Computational Science and Engineering at the Universität der Bundeswehr Munich, April 7, 2022*

R. SACHSE, F. GEIGER, M. BISCHOFF. Constrained motion design for adaptive structures based on a variational formulation. *GAMM 2020/21, 91st Annual Meeting of the International Association of Applied Mathematics and Mechanics, Kassel, Germany, March 15-19, 2021*

R. SACHSE, M. BISCHOFF. A variational formulation for motion design of adaptive structures. *GAMM 2019, 90th Annual Meeting of the International Association of Applied Mathematics and Mechanics, Vienna, Austria, February 20-24, 2019*

R. SACHSE, A. KÖRNER, A. WESTERMEIER, L. BORN, S. POPPINGA, G. GRESSER, T. SPECK, J. KNIPPERS, M. BISCHOFF. Biological Design and Integrative Structures – Simulation in der Biomimetik. *Forschungskolloquium FE im Schnee, Hirschegg, Austria, March 25-28, 2018*

R. SACHSE, M. BISCHOFF. A variational formulation for motion design of adaptive structures. *6th European Conference on Computational Mechanics (ECCM - ECFD 2018), Glasgow, UK, June 11-15, 2018*

R. SACHSE, B. OESTERLE, E. RAMM, M. BISCHOFF. Hierarchic isogeometric large rotation shell elements including linearized transverse shear parametrization. *7th GACM Colloquium on Computational Mechanics, Stuttgart, Germany, October 11-13, 2017*

R. SACHSE, A. KÖRNER, A. WESTERMEIER, L. BORN, S. POPPINGA, G. GRESSER, T. SPECK, M. BISCHOFF, J. KNIPPERS. Design process of a biomimetic facade element inspired by the carnivorous plant *Aldrovanda vesiculosa*. *7th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS), Crete, Greece, June 5-10, 2016*

ORGANIZED MINISYMPOSIA, CONFERENCES AND SCIENTIFIC EVENTS

Organization of a mini-symposium at the *9th European Congress on Computational Methods in Applied Sciences and Engineering* in Lisbon, Portugal, June 3-7, 2024 on “Computational methods for soft robotics”

Organization of a mini-symposium at the *10th GACM Colloquium on Computational Mechanics* in Vienna, Austria, September 10-13, 2023 on “Current trends in modeling and simulation of biological systems: numeric, application and data integration”

Organization of a mini-symposium at the *9th GACM Colloquium on Computational Mechanics* in Essen, Germany, September 21-23, 2022 on “Computational biomechanics and biomedical engineering of active biological systems – from methods to clinical application”

Organization of a mini-symposium at the *8th European Congress on Computational Methods in Applied Sciences and Engineering* in Oslo, Norway, June 5-9, 2022 on “Adaptive and compliant engineering structures”

Organization of a mini-symposium at the *15th World Congress on Computational Mechanics and 8th Asian Pacific Congress on Computational Mechanics* in Yokohama, Japan, July 31-August 5, 2022 on “Musculoskeletal biomechanics”

Co-organization of the *Pre-GAMM – Onboarding for young researchers – Workshop* – a technical workshop with a short introduction into the topics of the plenary lectures of the GAMM Annual Meeting on a beginner level. Online workshop with 6 speakers and over 90 participants.

Organization of a mini-symposium at the *14th World Congress on Computational Mechanics and 8th European Congress on Computational Methods in Applied Sciences and Engineering*, Paris, France, January 11-15, 2021 on “Adaptive engineering structures”

Co-organization of the *14th Baustatik-Baupraxis Conference*, Stuttgart, Germany, March 23-24, 2020 (around 300 participants) (*cancelled on short notice due to COVID-19*)

Co-organization of the *7th GACM Colloquium on Computational Mechanics*, Stuttgart, Germany, October 11-13, 2017 (around 250 participants)

Organization of a mini-symposium at the *7th GACM Colloquium on Computational Mechanics*, Stuttgart, Germany, October 11-13, 2017 on “Computational mechanics in biomimetics”

LIST OF PUBLICATIONS

Peer-reviewed journal articles

- [1] G. M. DURAK, R. THIERER, **R. SACHSE**, M. BISCHOFF, T. SPECK, S. POPPINGA. Smooth or with a snap! Trap opening mechanisms of the Venus flytrap (*Dionaea muscipula*). *Advanced Science*. 2022. DOI: <https://doi.org/10.1002/advs.202201362>
- [2] C. J. EGER, M. HORSTMANN, S. POPPINGA, **R. SACHSE**, R. THIERER, N. NESTLE, B. BRUCHMANN, T. SPECK, M. BISCHOFF, J. RÜHE. The structural and mechanical basis for passive-hydraulic pine cone actuation. *Advanced Science*. 2022. DOI: [10.1002/advs.202200458](https://doi.org/10.1002/advs.202200458)
- [3] F. KRÜGER, R. THIERER, Y. TAHOUNI, **R. SACHSE**, D. WOOD, A. MENGES, M. BISCHOFF, J. RÜHE. Development of a material design space for 4D-printed bio-inspired hygroscopically actuated bilayer structures with unequal effective layer widths. *Biomimetics*. 2021. DOI: [10.3390/biomimetics6040058](https://doi.org/10.3390/biomimetics6040058) – selected as the most cited paper published in 2021 in Biomimetics
- [4] **R. SACHSE**, F. GEIGER, M. VON SCHEVEN, M. BISCHOFF. Motion design with efficient actuator placement for adaptive structures that perform large deformations. *Frontiers in Built Environment* 7 (88). 2021. DOI: [10.3389/fbuil.2021.545962](https://doi.org/10.3389/fbuil.2021.545962)
- [5] **R. SACHSE**, F. GEIGER, M. BISCHOFF. Constrained motion design with distinct actuators and motion stabilization. *International Journal for Numerical Methods in Engineering* 122 (11). 2021. DOI: [10.1002/nme.6638](https://doi.org/10.1002/nme.6638)
- [6] **R. SACHSE**, M. BISCHOFF. A variational formulation for motion design of adaptive compliant structures. *International Journal for Numerical Methods in Engineering*. 2020. DOI: [10.1002/nme.6570](https://doi.org/10.1002/nme.6570)
- [7] **R. SACHSE**, A. WESTERMEIER, M. MYLO, J. NADASDI, M. BISCHOFF, T. SPECK, S. POPPINGA. Snapping mechanics of the Venus flytrap. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, 117. 2020. DOI: [10.1073/pnas.2002707117](https://doi.org/10.1073/pnas.2002707117)
- [8] A. KÖRNER, L. BORN, A. MADER, **R. SACHSE**, S. SAFFARIAN, A. S. WESTERMEIER, S. POPPINGA, M. BISCHOFF, G. T. GRESSER, M. MILWICH, T. SPECK, J. KNIPPERS. Flectofold – a biomimetic compliant shading device for complex free form facades. *Smart Materials and Structures*, 27. 2018. DOI: [10.1088/1361-665X/aa9c2f](https://doi.org/10.1088/1361-665X/aa9c2f)
- [9] A. S. WESTERMEIER, **R. SACHSE**, S. POPPINGA, P. VÖGELE, L. ADAMEC, T. SPECK, M. BISCHOFF. How the carnivorous waterwheel plant (*Aldrovanda vesiculosa*) snaps. *Proceedings of the Royal Society B*, 285. 2018. DOI: [10.1098/rspb.2018.0012](https://doi.org/10.1098/rspb.2018.0012)
- [10] B. OESTERLE, **R. SACHSE**, E. RAMM, M. BISCHOFF. Hierarchic isogeometric large rotation shell elements including linearized transverse shear parametrization. *Computer Methods in Applied Mechanics and Engineering*, 321. 2017. DOI: [10.1016/j.cma.2017.03.031](https://doi.org/10.1016/j.cma.2017.03.031)

Peer-reviewed conference proceedings

- [11] Y. TAHOUNI, T. CHENG, D. WOOD, **R. SACHSE**, R. THIERER, M. BISCHOFF, A. MENGES. Self-shaping curved folding: A 4D-printing method for fabrication of self-folding curved crease structures. *Symposium on Computational Fabrication*, 1-11. DOI: [10.1145/3424630.3425416](https://doi.org/10.1145/3424630.3425416)

Other conference proceedings

- [12] B. OESTERLE, S. BIEBER, **R. SACHSE**, E. RAMM, M. BISCHOFF. Intrinsically locking-free formulations for isogeometric beam, plate and shell analysis. *Proc. Appl. Math. Mech.*, 18. 2018. DOI: [10.1002/pamm.201800399](https://doi.org/10.1002/pamm.201800399)

- [13] B. OESTERLE, **R. SACHSE**, S. BIEBER, E. RAMM, M. BISCHOFF. Isogeometric analysis with hierarchic shell elements – intrinsically free from locking by alternative parametrizations. *Proceedings of the IASS Annual Symposium 2017. Annette Bögle, Manfred Grohmann (eds.) "Interfaces: architecture.engineering.science". September 25-28 2017, Hamburg, Germany. 2017.*
- [14] M. BISCHOFF, **R. SACHSE**, A. KÖRNER, A. WESTERMEIER, L. BORN, S. POPPINGA, G. T. GRESSER, T. SPECK, J. KNIPPERS. Modeling and analysis of the trapping mechanism of *Aldrovanda vesiculosa* as biomimetic inspiration for façade elements. *Proceedings of the IASS Annual Symposium 2017. Annette Bögle, Manfred Grohmann (eds.) "Interfaces: architecture.engineering.science". September 25-28, 2017, Hamburg, Germany. 2017.*
- [15] L. BORN, A. KÖRNER, G. SCHIEBER, A. WESTERMEIER, S. POPPINGA, **R. SACHSE**, P. BERGMANN, O. BETZ, M. BISCHOFF, T. SPECK, J. KNIPPERS, M. MILWICH AND G. T. GRESSER. Fiber-reinforced plastics with locally adapted stiffness for bio-inspired hingeless, deployable architectural systems. *Proceedings of the 21st Symposium on Composites, Bremen, Germany. 2017.*

Other articles and book contributions

- [16] **R. SACHSE**, M. BISCHOFF. Motion design for shape-changing structures. *ECCOMAS Newsletter July 2023. Link to Newsletter*
- [17] A. WESTERMEIER, S. POPPINGA, A. KÖRNER, L. BORN, **R. SACHSE**, S. SAFFARIAN, J. KNIPPERS, M. BISCHOFF, G. GRESSER, T. SPECK. Keine Gelenkbeschwerden – Wie Pflanzen sich bewegen und die Technik inspirieren. In: J. Knippers, U. Schmid & T. Speck (eds.), *Baubionik – Biologie beflügelt Architektur, 30–39. Stuttgarter Beiträge zur Naturkunde, Serie C, Band 82, Staatliches Museum für Naturkunde Stuttgart. 2017.*
- [18] S. POPPINGA, A. KÖRNER, **R. SACHSE**, L. BORN, A. WESTERMEIER, L. HESSE, J. KNIPPERS, M. BISCHOFF, G. T. GRESSER, T. SPECK. Compliant Mechanisms in Plants and Architecture. In: Jan Knippers, Klaus G. Nickel, Thomas Speck (Eds.). *Biomimetic Research for Architecture and Building Construction. Volume 8 of the series Biologically-Inspired Systems. Springer. 2016. DOI: 10.1007/978-3-319-46374-2_9*

Theses

- [19] **R. SACHSE**. Variational Motion Design for Adaptive Structures. PhD Thesis. *Report Nr. 72, Institute for Structural Mechanics, University of Stuttgart. 2020.*
- [20] **R. SACHSE**. Isogeometric Contact Analysis of Thin-Walled Structures. Master's Thesis. *Institute for Structural Mechanics, University of Stuttgart. 2014.*
- [21] **R. SACHSE**. An Elementary School Pavilion for Magagula in South Africa – Structural Analysis. Bachelor's Thesis. *Institute for Structural Mechanics, University of Stuttgart. 2011.*