Axel Loewe's Publications

1 Peer-reviewed Journal Articles[1]

Forthcoming

[j91] Barrios Espinosa, C., Sánchez, J., Appel, S., Becker, S., Krauß, J., Martínez Díaz, P., Unger, L., Houillon, M., and **Loewe, A.** "A Cyclical Fast Iterative Method for Simulating Reentries in Cardiac Electrophysiology Using an Eikonal-Based Model", under review. Preprint available. URL: https://arxiv.org/abs/2406.18619.

[j90] Houillon, M., Klar, J., Boutanios, Z., Stary, T., Cojean, T., Anzt, H., and **Loewe, A.** "FACILE-RS: archival and long term preservation of research software repositories made easy", under review. Preprint available. URL: https://github.com/openjournals/joss-papers/blob/joss.06909/joss.06909/10.21105.joss.06909.pdf.

[j89] Linder, M., Stary, T., Bitay, G., Nagy, N., and **Loewe, A.** "Sympathetic Stimulation Can Compensate for Hypocalcaemia-Induced Bradycardia in Human and Rabbit Sinoatrial Node Cells", under review. Preprint available. DOI: 10.1101/2024.08.30.610432.

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[j88] Gerach, T. and **Loewe, A.** "Differential Effects of Mechano-Electric Feedback Mechanisms on Whole Heart Activation, Repolarization, and Tension". *The Journal of Physiology* 2024;602:4605–4624. DOI: 10.1113/JP285022.

[j87] Mehari, T., Sundar, A., Bosnjakovic, A., Harris, P., Williams, S. E., **Loewe, A.**, Doessel, O., Nagel, C., Strodthoff, C., and Aston, P. J. "ECG Feature Importance Rankings: Cardiologists vs. Algorithms". *IEEE Journal of Biomedical and Health Informatics* 2024;28(4):2014–2194. DOI: 10.1109/JBHI.2024.3354301.

[j86] Jadidi, A. and **Loewe, A.** "Editorial: ECG-based Stroke Prediction in Patients with Atrial Fibrillation – Time to Exploit the ECG!" *Heart Rhythm* 2024. DOI: 10.1016/j.hrthm.2024.09.050.

[j85] Martínez Díaz, P., Dasí, A., Goetz, C., Unger, L., Haas, A., Luik, A., Rodriguez, B., Dössel, O., and **Loewe, A.** "Impact of Effective Refractory Period Personalization on Arrhythmia Vulnerability in Patient-Specific Atrial Computer Models". *Europace* 2024;26:euae215. DOI: 10.1093/europace/euae215.

[j84] Dasí, A., Nagel, C., Pope, M. T. B., Wijesurendra, R. S., Betts, T. R., Sachetto, R., **Loewe, A.**, Bueno-Orovio, A., and Rodriguez, B. "In Silico TRials guide optimal stratification of ATrIal FIbrillation patients to Catheter Ablation and pharmacological medicaTION: the i-STRATIFICATION study". *Europace* 2024;26(6). DOI: 10.1093/europace/euae150.

[j83] Fröhlich, J., Gerach, T., Krauß, J., **Loewe, A.**, Stengel, L., and Wieners, C. "Numerical evaluation of elasto-mechanical and visco-elastic electro-mechanical models of the human heart". *GAMM Mitteilungen - Surveys for Applied Mathematics and Mechanics* 2024;46(3–4):e202370010. DOI: 10.1002/gamm.202370010.

[j82] Martínez Díaz, P., Sánchez, J., Fitzen, N. A., Ravens, U., Dössel, O., and **Loewe, A.** "The Right Atrium Affects in silico Arrhythmia Vulnerability in Both Atria". *Heart Rhythm* 2024;21(6):799–805. DOI: 10.1016/j.hrthm.2024.01.047.

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[j80] Rinné, S., Oertli, A., Nagel, C., Tomsits, P., Jenewin, T., Kääb, S., Kauferstein, S., **Loewe, A.**, Beckmann, B. M., and Decher, N. "Characterization of a Spectrum of Novel Disease-Associated KCNQ1 Variants Identified in Romano-Ward Syndrome". *International Journal of Molecular Sciences* 2023;24(2):1350. DOI: 10.3390/ijms24021350.

[1] Equal contributions by several authors are denoted by *.

[j79] Nagel, C., Barrios Espinosa, C., Gillette, K., Sánchez, J., Plank, G., Dössel, O., and **Loewe, A.** "Comparison of propagation models and forward calculation methods on cellular, tissue and organ scale atrial electrophysiology". *IEEE Transactions on Biomedical Engineering* 2023;70(2):511–522. DOI: 10.1109/TBME.2022.3196144.

[j78] Nairn, D., Eichenlaub, M., Müller-Edenborn, B., Lehrmann, H., Nagel, C., Azzolin, L., Luongo, G., Ventura, R. M. F., Forcada, B. R., Colomer, A. V., Arentz, T., Dössel, O., **Loewe, A.**, and Jadidi, A. "Differences in atrial substrate localization using late gadolinium enhancement-magnetic resonance imaging, electrogram voltage, and conduction velocity: a cohort study using a consistent anatomical reference frame in patients with persistent atrial fibrillation". *Europace* 2023;25(9):euad278. DOI: 10.1093/europace/euad278.

[j77] **Loewe, A.** and Jadidi, A. "Editorial: Atrial arrhythmogenic substrate assessment – Is seeing always knowing?" *Journal of Cardiovascular Electrophysiology* 2023;34(2):313–314. DOI: 10.1111/jce.15792.

[j76] Matas, J. F. R., Berenfeld, O., Corino, V., **Loewe, A.**, and Martínez, J. P. "Editorial: Atrial Fibrillation - Technology for Diagnosis, Monitoring, and Treatment, Volume II". *Frontiers in Physiology* 2023;14:1209458. DOI: 10.3389/fphys.2023.1209458.

[j75] Jadidi, A. and **Loewe, A.** "Editorial: Omnipolar Voltage: A Novel Modality for Rhythm-Independent Identification of the Atrial Low-Voltage Substrate During AF?" *JACC Clinical Electrophysiology* 2023;9(28):1513–1514. DOI: 10.1016/j.jacep.2023.04.001.

[j74] **Loewe, A.**, Luik, A., Sassi, R., and Laguna, P. "Editorial: Together we are strong! Collaboration between clinicians and engineers as an enabler for better diagnosis and therapy of atrial arrhythmias". *Medical & Biological Engineering & Computing* 2023;61:875–877. DOI: 10.1007/s11517-023-02788-0.

[j73] Lindner, L., Gerach, T., Jahnke, T., **Loewe, A.**, Weiss, D., and Wieners, C. "Efficient time splitting schemes for the monodomain equation in cardiac electrophysiology". *International Journal for Numerical Methods in Biomedical Engineering* 2023;39(2):e3666. DOI: 10.1002/cnm.3666.

[j72] Winkler, B., Nagel, C., Farchmin, N., Heidenreich, S., **Loewe, A.**, Dössel, O., and Bär, M. "Global Sensitivity Analysis and Uncertainty Quantification of Synthetic Atrial Electrocardiogram Data via Polynomial Chaos Expansion". *Metrology* 2023;3(1):1–28. DOI: 10.3390/metrology3010001.

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[j62] Amsaleg*, A., Sánchez Arciniegas*, J., Mikut, R., and **Loewe, A.** "Characterization of the Pace-and-Drive Capacity of the Human Sinoatrial Node: a 3D in silico Study". *Biophysical Journal* 2022;121(22):4247–4259. DOI: 10.1016/j.bpj.2022.10.020.

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5 Invited Talks

2024 [t29] **Loewe, A.** "Computational Modeling and Simulation of the ECG as an Enabling Technology for Machine Learning". In: International Congress on Electrocardiology 2024. Lund, Sweden.

[t28] **Loewe, A.** "Computational models of the human heart: linking information across species and scales". In: 5th Translational Workshop of the German Cardiac Society 2024. Hamburg, Germany.

[t27] **Loewe, A.** "Computermodelle des Herzens". In: Arbeitskreis Digitale Medizin 2024. Heidelberg, Germany.

[t26] **Loewe, A.** "Digital chimeras to enable in silico clinical trials of ablation strategies to terminate atrial fibrillation and prevent recurrence". In: Computational Modelling in Medicine 2024. University of Nottingham, UK.

[t25] **Loewe, A.** "Digital chimeras to enable in silico trials at scale". In: Fickle Heart: The intersection of UQ, AI and Digital Twins 2024. Cambridge, UK.

[t24] **Loewe, A.** "Mechanistic Modeling and Simulation of the ECG as an Enabling Technology for Machine Learning: Concepts, Datasets, and Real-World Performance". In: BMT 2024 - 58th Annual Conference of the German Society for Biomedical Engineering (VDE|DGBMT) 2024. Stuttgart, Germany.

[t23] **Loewe, A.** "Modeling & Simulation of Cardiac Function: Combining Mechanistic Models and Artificial Intelligence". In: Medical Information Sciences Seminar 2024. University of Augsburg.

[t22] **Loewe, A.** "Modeling & simulation of cardiac function: combining mechanistic models and artificial intelligence". In: 2024. Tampere University, Finnland.

[t21] **Loewe, A.** "Modeling & simulation of cardiac function: combining mechanistic models and artificial intelligence". In: Edwards Life Sciences Seminar 2024.

[t20] **Loewe, A.** "Real-world and synthetic ECG data for prediction models: synergistic combination of mechanistic and data-driven models". In: Atrial Signals 2024. Maastricht, The Netherlands.

[t19] **Loewe, A.** "Supervised & unsupervised machine learning". In: Artificial Intelligence for Life Scientists 2024. online.

[t18] **Loewe, A.** "Synergies between mechanistic and data-driven models in medical research". In: Helmholtz Information & Data Science Academy (HIDA) Lectures 2024. online. URL: https://www.youtube.com/watch?v=gw22xAaTKyQ.

2023 [t17] **Loewe, A.** "Digital chimeras to enable in silico clinical trials of ablation strategies to terminate atrial fibrillation and prevent recurrence". In: Special Semester on Mathematical Methods in Medicine, Johann Radon Institute for Computational and Applied Mathematics 2023. Linz, Austria.

[t16] **Loewe, A.** "Health Technologies at KIT". In: VDI Carl-Benz-Kreis 2023. Karlsruhe, Germany.

[t15] **Loewe, A.** "Modeling & Simulation of the Human Atria – Statistical Shape Models & Electrograms". In: NumeriCor Cardiac Modeling Summit 2023. Graz, Austria.

2022 [t14] **Loewe, A.** and Jadidi, A. "Computational Cardiac Modeling – Synergies with Machine Learning and Clinical Translation". In: Oxford Symposium on the Future of Therapy Discovery and Development 2022. Oxford, UK.

[t13] **Loewe, A.** "Computermodellierung und maschinelles Lernen in der kardiovaskulären Medizin". In: *Clinical Research in Cardiology*. 88th Annual Meeting of the German Cardiac Society (DGK) 2022. Mannheim, Germany. P. V1272. DOI: 10.1007/s00392-022-02002-5.

[t12] **Loewe, A.** "Contemporary ECGI Research". In: ECG Imaging Symposium 2022. Tampere, Finland.

[t11] **Loewe, A.** "Mein digitaler Zwilling: Welche Möglichkeiten eröffnen mathematische Computermodelle des Herzens für die Diagnose und Therapie von Herzkrankheiten?" In: KIT im Rathaus (KIT in the city hall) 2022. Karlsruhe, Germany.

2021 [t10] **Loewe, A.** "Computational Cardiac Modeling - Synergies with Machine Learning". In: Cardiac Electromechanics Research Group (Prof. Niederer / Bishop), King's College London 2021. London, UK.

[t9] **Loewe, A.** "Predicting potential AFlut patterns using computational modeling". In: Atrial Signals Workshop 2021. Karlsruhe, Germany.

2019 [t8] **Loewe, A.** "The inverse problem of cardiac mechanics - estimation of cardiac active stress distribution through imaging-driven computational modeling". In: 9th International Congress on Industrial and Applied Mathemarics 2019. Valencia, Spain.

[t7] **Loewe, A.** "The inverse problem of cardiac mechanics - estimation of cardiac active stress from endocardial motion tracking". In: 6th International Conference on Computational and Mathematical Biomedical Engineering 2019. Sendai City, Japan.

2017 [t6] **Loewe, A.** "Multiscale modeling of cardiac electrophysiology". In: School of Science and Engineering, Reykjavik University / Háskólann í Reykjavík 2017. Reykjavik, Iceland.

[t5] **Loewe, A.** "Validation upside down - In-silico models to sound the potential and limitations of diagnostic tools". In: TRM Forum 2017. Lugano, Switzerland.

2016 [t4] **Loewe, A.** "Multiscale computational cardiology". In: Computational Physiopathology Unit (Prof. Stefano Severi), University of Bologna 2016. Bologna, Italy.

2015 [t3] **Loewe, A.** "In-silico Assessment of the Dynamic Effects of Amiodarone and Dronedarone on Human Atrial Patho-Electrophysiology". In: Emerging Mathematical Topics in Biology and Life Sciences 2015. Graz, Austria.

2014 [t2] **Loewe, A.** "Modeling human atrial patho-electrophysiology: genetic defects and pharmacological agents". In: Simula Cardiac Modeling Workshop 2014. Oslo, Norway.

[t1] **Loewe, A.** "Multiscale in silico modeling of human atrial electrophysiology". In: Computational Cardiology Lab (Prof. Natalia Trayanova), Johns Hopkins University 2014. Baltimore, USA.

6 Patents

2022 [pa5] Azzolin, L., **Loewe, A.**, Dössel, O., Nairn, D., Nagel, C., Sánchez, J., Unger, L., and Zheng, T. *Automated pipeline to generate augmented anatomical and functional atrial digital twins*. European Patent Application.

2021 [pa4] Müller-Edenborn, B., Jadidi, A., **Loewe, A.**, and Luongo, G. *Algorithm to identify patients with atrial fibrillation-induced heart failure*. German Patent Application.

2019 [pa3] Oesterlein, T., Dössel, O., Frisch, D., **Loewe, A.**, Lenis, G., and Pilia, N. *Method and system for determining ventricular far field contribution in atrial electrograms*. United States Patent Application 20190059765, 16/111092.

2015 [pa2] Liu, J., Yang, Z., Nadar, M. S., Janardhanan, N., Wang, Q., and **Loewe, A.** *Multi-stage Magnetic Resonance Reconstruction for Parallel Imaging Applications*. United States Patent 9097780.

2014 [pa1] Lefebvre, A., **Loewe, A.**, Nadar, M. S., and Liu, J. *Zero communication block partitioning*. United States Patent 9286648B2.

7 Public Outreach / Popular Science

2024 [o11] Marburger, H. "Computermodelle und Maschinelles Lernen verbessern die Herzdiagnostik". *lookKIT* 2024;(2), 10–13. URL: https://www.sts.kit.edu/downloads/lookkit-202402.pdf.

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2023 [o9] ZEISS Innovation Hub@KIT. "Unveiling the Digital Heart Twin". *Podcast - A coffee with...* 2023. URL: https://open.spotify.com/episode/6OctAEO6nGQx2asbRa3V7D?si=c41b2bd6d1184005.

[o8] KIT Campus Report. "Zentimetergenaue Lokalisierung durch Künstliche Intelligenz" – KIT-Forschungsprojekt will Diagnose von Herzrhythmusstörungen erleichtern". *Podcast* 2023. URL: https://medienportal.bibliothek.kit.edu/details/DIVA-2023-269.

2022 [o7] **Loewe, A.** and Anzt, H. "Es ist Zeit über Forschungssoftware zu reden". *Wissenschaftsmanagement* 2022;2021:56–61. URL: https://www.wissenschaftsmanagement.de/news/es-ist-zeit-ueber-forschungssoftware-zu-reden.

[o6] KIT im Rathaus. "Mein digitaler Zwilling: Welche Möglichkeiten eröffnen mathematische Computermodelle des Herzens für die Diagnose und Therapie von Herzkrankheiten?" *YouTube* 2022. URL: https://www.youtube.com/watch?v=iLLlXTmFFMc&list=PL0TmH52ybqIfnLU0b1TKz8qFCuEJyRNJk&index=3.

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[o2] Luik, A., Unger, L., and **Loewe, A.** "Fortschritt - erst technisch dann klinisch". *Cardio News* 2021;24(11/12):24.

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[o-1] Fakultät für Elektrotechnik und Informationstechnik. "Studieren am KIT: Elektrotechnik und Informationstechnik (ETIT)". *YouTube* 2021. URL: https://www.youtube.com/watch?v=m7q0o1KqVcE.

2020 [o-2] **Loewe, A.** "Ein digitales Herz". *Spektrum der Wissenschaft* 2020;20(10):44–48.

[o-3] Lohrer, M. and **Loewe, A.** "Herzsimulator 1.0". *dotnetpro* 2020;2020(1):13–19.

[o-4] **Loewe, A.** "Mit Computerherz zum Therapieerfolg". *KIT NEULAND* 2020, 36–43. URL: https://kit-neuland.de/de/magazin/projekte/mit-computerherz-zum-therapieerfolg#site-contents-568.

2019 [o-5] Hallensleben, S. and **Loewe, A.** "Wie wirken Arzt und digitale Technik im Jahr 2035 zusammen?" *VDE DGBMT* 2019.

2018 [o-6] KIT Campus Report. "Ein Schritt zur individualisierten Medizin - Computersimulationen des Vorhofflimmerns ermöglichen wirksamere Therapien". *Podcast* 2018. URL: https://medienportal.bibliothek.kit.edu/details/DIVA-2018-664.

[o-7] **Loewe, A.** "Mit Vortests zur besten Therapie - KIT-Forscher simuliert am PC Behandlungsmethoden bei Vorhofflimmern". *Badische Neueste Nachrichten* 2018.

See CV for further dissemination and outreach activities.

8 Book Chapters and Monographs

2024 [b13] Viceconti, M., Geris, L., Emili, L., **Loewe, A.**, Staumont, B., Morales-Orcajo, E., Horner, M., De Cunha Maluf-Burgman, M., and Lesage, R. "Introduction". In: *Toward Good Simulation Practice*. 2024. Springer Nature Switzerland. Pp. 1–8. ISBN: 9783031482847. DOI: 10.1007/978-3-031-48284-7_1.

[b12] Kulesza, A., **Loewe, A.**, Stenti, A., Nicolò, C., Morales-Orcajo, E., Courcelles, E., Sips, F., Pappalardo, F., Russo, G., Horner, M., Viceconti, M., De Cunha Maluf-Burgman, M., Lesage, R., and Kreuzer, S. "Model Development". In: *Toward Good Simulation Practice*. 2024. Springer Nature Switzerland. Pp. 25–42. ISBN: 9783031482847. DOI: 10.1007/978-3-031-48284-7_3.

[b11] Lesage, R., **Loewe, A.**, Morales-Orcajo, E., and Viceconti, M. "The Investigator: Modellers and Analysts". In: *Toward Good Simulation Practice*. 2024. Springer Nature Switzerland. Pp. 115–122. ISBN: 9783031482847. DOI: 10.1007/978-3-031-48284-7_9.

[b10] Viceconti, M., Juárez, M., **Loewe, A.**, Calvetti, D., Somersalo, E., Geris, L., Horner, M., and De Cunha Maluf-Burgman, M. "Theoretical Foundations of Good Simulation Practice". In: *Toward Good Simulation Practice*. 2024. Springer Nature Switzerland. Pp. 9–23. ISBN: 9783031482847. DOI: 10.1007/978-3-031-48284-7_2.

2022 [b9] Matas, J. F. R., Berenfeld, O., **Loewe, A.**, Corino, V., and Martínez, J. P., eds. *Atrial Fibrillation: Technology for Diagnosis, Monitoring, and Treatment, Volume II*. 2022. Frontiers Media SA. DOI: 10.3389/978-2-8325-2466-4.

[b8] Matas, J. F. R., Berenfeld, O., **Loewe, A.**, Corino, V., and Martínez, J. P., eds. *Atrial Fibrillation: Technology for Diagnosis, Monitoring, and Treatment*. 2022. Frontiers Media SA. DOI: 10.3389/978-2-88974-690-3.

[b7] **Loewe, A.**, Martínez Díaz, P., Nagel, C., and Sánchez, J. "Cardiac Digital Twin Modeling". In: *Innovative treatment strategies for clinical electrophysiology*. Ed. by T. Jadczyk, A. Loewe, G. Caluori, and K. S. Golba. 2022. Springer. DOI: 10.1007/978-981-19-6649-1_7.

[b6] Jadczyk, T., **Loewe, A.**, Caluori, G., and Golba, K. S., eds. *Innovative Treatment Strategies for Clinical Electrophysiology*. Lecture Notes in Bioengineering 2022. Springer. ISBN: 978-981-19-6648-4. DOI: 10.1007/978-981-19-6649-1.

[b5] **Loewe, A.**, Luongo, G., and Sánchez, J. "Machine Learning for Clinical Electrophyisology". In: *Innovative treatment strategies for clinical electrophysiology*. Ed. by T. Jadczyk, A. Loewe, G. Caluori, and K. S. Golba. 2022. Springer. DOI: 10.1007/978-981-19-6649-1_6.

2021 [b4] **Loewe, A.** "Simulation of Cardiac Electrophysiology and Biomechanics: from Model Development to Clinical Translation". Habilitation Thesis. Karlsruhe Institute of Technology (KIT).

2016 [b3] **Loewe, A.** "Modeling human atrial patho-electrophysiology from ion channels to ECG : substrates, pharmacology, vulnerability, and P-waves". PhD thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/KSP/1000054615.

2013 [b2] **Loewe, A.** "Arrhythmic potency of human electrophysiological models adapted to chronic and familial atrial fibrillation". Master Thesis. Karlsruhe Institute of Technology (KIT).

2010 [b1] **Loewe, A.** "Comparison of cardiac simulation tools regarding the modeling of acute ischemia". Bachelor Thesis. Karlsruhe Institute of Technology (KIT).

9 Reviewer Activity

9.1 Funding Agencies

- *Association of Collaborating Health Foundations (SGF)*
- *Bayerisches Staatsministerium für Wissenschaft und Kunst*
- *Bayerische Forschungsstiftung*
- *Belgian Physical Society*
- *British Heart Foundation*
- *Czech Academy of Sciences, member of evaluation panel "Engineering and Technology"*
- *Deutsche Forschungsgemeinschaft*
- *Dutch Heart Foundation*
- *Dutch Research Council (NWO)*
- *ETH Zurich*
- *European Research Council (ERC)*
- *Fondazione Leonardo*
- *Heart Research UK*
- *Heidelberger Akademie der Wissenschaften*
- *Medical Research Council, United Kingdom*
- *Medical Research Foundation, United Kingdom*
- *National Science Center, Poland*
- *Swiss National Science Foundation*
- *UKRI Engineering and Physical Sciences Research Council*
- *Wellcome Trust*

9.2 Scientific Journals and Conferences

- *American Journal of Physiology - Heart and Circulatory Physiology* (2023-24)
- *Annals of Biomedical Engineering* (2019-20)
- *Annals of Noninvasive Electrocardiology* (2024)
- *Artificial Intelligence in Medicine* (2024)
- *Biomechanics and Modeling in Mechanobiology* (2020, 2023-24)
- *Biomedizinische Technik Conference (Annual Meeting of the German Society for Biomedical Engineernig)* (2022-24)
- *Biophysical Journal* (2019, 2022)
- *BMC Medical Research Methodology* (2023)
- *BMC Nephrology* (2021)
- *Cardiology Research and Practice* (2021)
- *Cardiovascular Engineering and Technology* (2021)
- *Cardiovascular Research* (2018, 2022-24)
- *Chaos, Solitions and Fractals* (2024)
- *Circulation: Arrhythmia and Electrophyisology* (2021)
- *Clinical Medicine Insights Cardiology* (2019)

- *Computers in Biology and Medicine* (2018-21)
- *Computers Methods and Programs in Biomedicine* (2024)
- *Computing in Cardiology Conference* (2017-23)
- *eLIFE* (2021)
- *Engineering with Computers* (2022)
- *Europace* (2016-21, 2023-24)
- *European Heart Journal* (2022)
- *European Heart Journal - Digital Health* (2023)
- *Expert Systems with Applications* (2022, 2024)
- *Frontiers in Cardiovascular Medicine* (2020, 2022)
- *Frontiers in Physiology* (2017, 2019-23)
- *Functional Imaging and Modeling of the Heart Conference* (2023)
- *Heart Rhythm Journal* (2017-19, 2022-24)
- *Heart Rhythm Society Annual Meeting* (2023-24)
- *Heliyon* (2023)
- *IEEE Journal of Biomedical and Health Informatics* (2023-24)
- *IEEE Transactions on Automation Science and Engineering* (2022)
- *IEEE Transactions on Biomedical Engineering* (2016, 2019-21, 2023)
- *IEEE Transactions on Medical Imaging* (2022)
- *Interface Focus* (2023)
- *International Journal of Cardiology* (2024)
- *International Journal of Clinical Cardiology* (2017)
- *International Journal for Numerical Methods in Biomedical Engineering* (2022)
- *JACC Clinical Electrophysiology* (2021-22)
- *Journal of Cardiovascular Electrophysiology* (2021-22)
- *Journal of Computational Physics* (2021)
- *Journal of Electrocardiology* (2024)
- *Journal of Open Source Software* (2021-22)
- *Journal of the American Heart Association* (2023-24)
- *Mathematics* (2022)
- *Medical and Biological Engineering and Computing* (2016-17, 2019)
- *Medical Image Analysis* (2020-21, 2023-24)
- *Nature Cardiovascular Research* (2023-24)
- *Neural Networks* (2024)
- *Pflügers Archiv - European Journal of Physiology* (2023)
- *Platform for Advanced Scientific Computing (PASC) Conference* (2021)
- *Philosophical Transactions of the Royal Society A* (2019-20)
- *Physiological Reports* (2022)
- *PLOS Computational Biology* (2017, 2019)
- *PLOS ONE* (2019)
- *Scientific Reports* (2023)

- *Simulation: Transactions of the Society for Modeling and Simulation* (2018)
- *Wellcome Open Research* (2022)
- *Workshop Biosignale* (2022, 2024)

9.3 Universities

- *Freiburg University* (2024)
- *Ghent University* (2021)
- *KIT Department of Mathematics* (2022, 2024)
- *KIT Department of Electrical Engineering and Information Technology* (2020-2024)
- *Maastricht University* (2024)
- *Politecnico di Milano* (2021)
- *Tampere University* (2024)
- *Università degli Studi di Milano* (2022)
- *Università di Bologna* (2024)
- *Universitat Politècnica de València* (2024)
- *University of Auckland* (2023-24)

Axel Loewe's Supervisions

10 Supervised PhD Students

[13] Martínez Díaz, L P. 2024. *"Personalization of Computer Models for the Assessment of Atrial Fibrillation Vulnerability"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000174866

[12] Martínez Anton, C. 2024. *"Local Impedance Characterization for Scar and Fibrosis Detection - Towards a New Substrate Assessment for Atrial Mapping"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000170565

[11] Brenneisen, J. 2023. *"Interaction of elastomechanics and fluid dynamics in the human heart : Opportunities and challenges of light coupling strategies"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000158111

[10] Nagel, C. 2022. *"Multiscale Cohort Modeling of Atrial Electrophysiology: Risk Stratification for Atrial Fibrillation through Machine Learning on Electrocardiograms"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000152993

[9] Gerach, T. 2022. *"Personalized Electromechanical Modeling of the Human Heart : Challenges and Opportunities for the Simulation of Pathophysiological Scenarios"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000147806

[8] Nairn, D. 2022. *"Multi-Modality Correspondence to Enhance Arrhythmogenic Atrial Substrate Identification: Guiding Persistent Atrial Fibrillation Ablation Therapy"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000144762

[7] Azzolin, L. 2021. *"Atrial Digital Twins to Assess Arrhythmia Vulnerability and Guide Ablation Therapy: Leverage Patient-Specific Atrial Models to Understand Atria Fibrillation Mechanisms and Provide Personalized Treatments"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000142101

[6] Luongo, G. 2021. *"Non-Invasive Atrial Arrhythmia Diagnosis Using the 12-Lead ECG: Machine Learning Leveraging in-silico and Clinical Signals"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000141417

[5] Nothstein, M. 2021. *"Characterizing Atrial Fibrillation Substrate by Electrogram and Restitution Analysis"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000140821

[4] Schuler, S. 2021. *"Novel Methods to Incorporate Physiological Prior Knowledge into the Inverse Problem of Electrocardiography: Application to Localization of Ventricular Excitation Origins"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000141624

[3] Kovacheva, E. 2021. *"Model Based Estimation of the Elastomechanical Properties of the Human Heart"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000135416

[2] Sánchez Arciniegas, J P. 2021. *"A Multiscale In Silico Study to Characterize the Atrial Electrical Activity of Patients With Atrial Fibrillation: A Translational Study to Guide Ablation Therapy"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/KSP/1000143481

[1] Lutz, Y. 2020. *"Modeling of the Human Brain to Predict Spatial and Temporal Temperature Profiles for the Selective Hypothermia Treatment of an Ischemic Stroke"*. PhD Thesis. Karlsruhe Institute of Technology (KIT). DOI: 10.5445/IR/1000122124

- Barrios Espinosa, C.A., expected 2025
- Krauß, J., expected 2026
- Steyer, J.F., expected 2026
- Tenbrink, L., expected 2026
- Götz, C., expected 2026
- Linder, M. expected 2026
- Appel, S. expected 2027

- Becker, S. expected 2027
- Mierisch, J. expected 2027
- Maierhofer, P.H. expected 2027

11 Supervised and Refereed Student Theses

[83] Maierhofer, P. 2024. *"Explainable Machine Learning for the Prediction of Arrhythmia Vulnerability"*. Master Thesis.
[82] Müller, E. 2024. *"Evaluation of the Suitability of Invertible Neural Networks for ECG-based Non-invasive Localization of Extrasystoles"*. Master Thesis.
[81] Ladner, A. 2024. *"Influence of Atrial Electrophysiological, Anatomical and Substrate Characteristics on Atrial Fibrillation Vulnerability Assessment"*. Master Thesis.
[80] Merkel, C. 2024. *"Using Variational Autoencoders to Encode and Augment Vectorcardiographic Signals"*. Master Thesis.
[79] Becker, S. 2023. *"Influence of Conduction Velocity Restitution on Vulnerability to and Maintenance of Atrial Fibrillation"*. Master Thesis.
[78] Krapp, K.-N. 2023. *"Evaluating the Effect of Federated Learning on Explainable Artificial Intelligence"*. Bachelor Thesis.
[77] Schicketanz, L. 2023. *"Modeling and Simulation of the Fetal ECG"*. Master Thesis.
[76] Lorenz, N. 2023. *"Design and Development of a Multichannel Fast-Scan Cyclic Voltammetry System for Neurotransmitter Detection Using Boron Doped Diamond Microelectrode Arrays and Machine Learning"*. Master Thesis.
[75] Raval, H. 2023. *"The eikonal based method to analyze the regional changes of patient with atrial fibrillation"*. Master Thesis.
[74] Duhme, J.-E. 2023. *"Effect of Increased Heart Rate on Active Tension Development"*. Bachelor Thesis.
[73] Keller, L. 2023. *"Influence of Electrical Propagation Patterns on Diffusion Currents"*. Bachelor Thesis.
[72] Caslli, N. 2023. *"EGMs vs. LI in Non Fully Transmural Scar Configurations"*. Bachelor Thesis.
[71] Fitzen, N. 2023. *"Impact of the Right Atrium on Arrhythmia Vulnerability Assessment and Fitting of a Statistical Shape Model for Augmentation of Missing Right Atria"*. Bachelor Thesis.
[70] Wörnle, C. 2023. *"Evaluation of Transcranial Magnetic Stimulation - Motor Mapping Methods"*. Master Thesis.
[69] Krnjaca, D. 2022. *"Generation of a Statistical Shape Model for the Liver"*. Bachelor Thesis.
[68] Prüßmeier, E. 2022. *"Entwicklung eines Teststandes für Handprothesen mit automatischer Fehlerdetektion durch Bilderkennung"*. Master Thesis.
[67] Götz, C. 2022. *"Atrial Segment Division Method for Regional and Quantitative Analysis"*. Master Thesis.
[66] Liu, H. 2022. *"Detection of Anxiety Using Non-Invasive Biosignals"*. Master Thesis.
[65] Reiß, M. 2022. *"Termination Prediction in Atrial Fibrillation via Intracardiac Electrograms using Signal Processing and Machine Learning"*. Master Thesis.
[64] Bender, J. 2022. *"Classification of Interatrial Conduction Block Based on P waves of the 12-lead ECG"*. Bachelor Thesis.
[63] Vu, M A. 2022. *"Analyse und Korrektur der Verzerrungseffekte an der Cornea in OCT Bildern"*. Master Thesis.
[62] Oberschulte, E. 2022. *"A novel low-energy pacing approach to control Atrial Fibrillation induced by a phase singularity distribution"*. Master Thesis.
[61] Miao, Y. 2022. *"Study of the intra-cardiac electrogram signals using in-silico experiments to asses the impact of the atrial geometry"*. Master Thesis.
[60] Shen, T. 2021. *"Comparison of Intra-Cardiac Mapping Modalities by Analysing the Amplitude of Electrogram Signals"*. Master Thesis.
[59] Osypka, J. 2021. *"Application of Deep Neural Networks for Clinical ECG-based Identification of Atrial Fibrosis"*. Master Thesis.
[58] Skupien, N. 2021. *"Refining the Eikonal Model to reproduce the Influnece of Geometrical Factors on Conduction Velocity"*. Master Thesis.

[57] Shoykhet, A. 2021. *"Analysis of Most Significant EEG Signals Associated with Motion Sickness Using Machine Learning"*. Bachelor Thesis.
[56] Huhn, O. 2021. *"Investigation of the Influence of Pole Geometries on Mapping and the Generation of Lesions by Pulsed Field Ablation"*. Master Thesis.
[55] Tejero Cervera, P. 2021. *"Source Estimation in Cardiac Fibrotic Substrate from Intracardiac Signals"*. Master Thesis.
[54] Sachs, M. 2021. *"Investigating the use of machine learning for classifying atrial diseases based on P-wave simulations on a biatrial shape model"*. Master Thesis.
[53] Zheng, T. 2021. *"Automatic patient-specific atrial model generation to study arrhythmia vulnerability"*. Master Thesis.
[52] Krames, L. 2021. *"Implementation and Evaluation of a (Semi-)Automatic Registration Framework for the Alignement of Pre- and Intra-operative Imaging Data in Laparosopic Liver Surgery"*. Master Thesis.
[51] Weiß, M. 2021. *"Bewertung und Anpassung der Mitralklappenimplementierung in einem parametrischen Kreislaufmodell basierend auf fluiddynamischen Simulationen"*. Master Thesis.
[50] Tischer, J. 2021. *"Implementation and assessment of a statistical fitting approach for detection of conduction velocity, anisotropy ratio and fiber orientation of cardiac tissue"*. Bachelor Thesis.
[49] Dzindo, H. 2020. *"Behavior and Transformation of Restitution Curves of Different Stimulation Protocols under Atrial Fibrillation Conditions"*. Bachelor Thesis.
[48] Esnaola Capa, J M. 2020. *"Co-Registration of Multimodal Datasets in Patint-Specific Computational Models to Correlate Fibrotic Area and Electograms' Signals"*. Master Thesis.
[47] Becker, S. 2020. *"Separating ECG changes caused by potassium channel blocks from changes by anormal potassium concentrations"*. Bachelor Thesis.
[46] Meinzer, M. 2020. *"Patientenabhängigkeit von Algorithmen zur Ionenkonzentrationrekonstruktion und deren Überwindung"*. Master Thesis.
[45] Koch, J. 2020. *"Enhancing Conduction Velocity Estimation by Atrial Electrogram Analysis"*. Bachelor Thesis.
[44] Schweda, C. 2020. *"Online Gastransferratenmessung und Performance-Indikation von Hohlfasermembranoxygenatoren"*. Master Thesis.
[43] Schicketanz, L. 2020. *"Erkennung von atrialen Nahfeld und Fernfeld Komponenten in Elektrogrammen bei atrialen Tachykardie"*. Bachelor Thesis.
[42] Sandrock, J. 2020. *"Ermittlung und Analyse einer Optimierungskurve über die Anzahl von Elektroden zur Erfassung von Myosignalen zur Steuerung einer Handprotheseattern Recognition"*. Master Thesis.
[41] Hunyar, D. 2020. *"Identification of how voltage is affected due to changes in electrode size and the use of a Lasso catheter using a computational model"*. Bachelor Thesis.
[40] Bettaieb, F. 2020. *"The Effect of Fibrosis Transmurality on Electrogram Morphology and Atrial Fibrillation Dynamics"*. Bachelor Thesis.
[39] Appel, S. 2020. *"Parameteroptimierung zur Regulierung der calciumabhängigen Kraftentwicklung in Herzmuskelzellen"*. Bachelor Thesis.
[38] Hii, K. 2020. *"Reorientation of an Atrial Model: to Simulate 12-lead ECG Signals: An Overfitting and Data Augmentation Problem"*. Bachelor Thesis.
[37] Andlauer, R. 2020. *"Bidirectional Translation Between Facial Image and 3D Reconstruction for Postoperative Face Prediction"*. Master Thesis.
[36] Reiß, M. 2020. *"Verbesserung der Genauigkeit bei der Bestimmung der Zeitdifferenz zwischen zwei Indikatordilutionskurven in Quantitativer Fluoreszenzangiographiewendung mathematischer Modelle"*. Bachelor Thesis.
[35] Schaufelberger, M. 2019. *"Activation Times Estimation in ECG Imaging: Comparison of Source Models and Estimation Methods"*. Master Thesis.
[34] Stritt, M. 2019. *"High-Density Mapping of Ablation Lesions for the Assessment of Myocardial Scar"*. Master Thesis.
[33] Troschke, A. 2019. *"Entwicklung eines Konzeptes zum Speichern gleichzeitiger Aufnahmen eines Multikameraaufbaus"*. Bachelor Thesis.
[32] Moik, G. 2019. *"Reconstruction of the Excitation Origin in the Ventricles using Body Surface Potential Maps"*. Master Thesis.
[31] Thämer, L. 2019. *"The Inverse Problem of the Heart Mechanics - Reconstruction of the Active Tension"*. Master Thesis.

[30] Brenneisen, J. 2019. *"Evaluation and comparison of multiple EIT reconstruction approaches on simulated and measured data with respect to cardiosynchronousty"*. Master Thesis.
[29] Hammami, F. 2019. *"Berechnung von spezifischen absorbierten Anteilen und ihren Unsicherheiten mit verschiedenen Voxelmodellen"*. Master Thesis.
[28] Meyer-Hilberg L. 2019. *"Investigation and Analysis of Spatio-Temporal ICG Fluorescence Signal of Intraoperative Angiography"*. Master Thesis.
[27] Greiner, J. 2019. *"Confocal Microscopy-Based Estimation of Passive Conductivity Tensors in the Normal and Infarcted Heart"*. Master Thesis.
[26] Smardanski, B. 2019. *"Diagnosing hypo- and hyperkalaemia and hypo- and hypercalcaemia with the 12-lead ECG"*. Master Thesis.
[25] Baumann, D. 2018. *"Robust Bi–Domain Registration of Vessels"*. Bachelor Thesis.
[24] Tabet I. 2019. *"Development and Quantitative Analysis of Automatic Electrical Impedance Tomography Signal Component Detection and Separation Algorithms"*. Bachelor Thesis.
[23] Nagel, C. 2019. *"Robust conduction velocity estimation in a clinical setting"*. Master Thesis.
[22] Luz, C. 2019. *"Determination and Transformation of conduction velocities during a catheter study using a computational model"*. Bachelor Thesis.c
[21] Meissner, T. 2019. *"Adaption and Partitioning of a Brain Geometry for Spatially Detailed Calculation of Local Cerebral Temperatures"*. Master Thesis.
[20] Fries, J. 2019. *"Konzeptionierung und Erweiterung des Virtual-Reality Operationssaals zu einem Mixed-Reality Operationssaal"*. Master Thesis.
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