Dr. Christoph M. Keplinger

University of Colorado Boulder
Paul M. Rady Department of Mechanical Engineering
UCB 427, Boulder, CO 80309, USA

www.KeplingerResearchGroup.com
E-mail: Christoph.Keplinger@colorado.edu
Phone: (303) 735-8064

Current Research Interests

- Robotic Materials, Embodied Intelligence, Artificial Muscles, Soft Robotics, Functional Polymers, Energy Capture

Appointments

Aug 2015 - Present	**Assistant Professor, University of Colorado Boulder** Mechanical Engineering & Materials Science and Engineering
Jul 2018 - Present	**Mollenkopf Faculty Fellow, University of Colorado Boulder**
Nov 2018 - Present	**Co-founder & Chief Science Officer (CSO), Artimus Robotics** (www.artimusrobotics.com) Spin-out commercializing the HASEL technology invented in the Keplinger Research Group
Dec 2012 - Jul 2015	**Postdoctoral Research Fellow, Harvard University** George M. Whitesides Group, Department of Chemistry and Chemical Biology
Dec 2011 - Nov 2012	**Postdoctoral Research Fellow, Harvard University** Zhigang Suo Group, School of Engineering and Applied Sciences
Sep 2008 - Sep 2011	**Graduate Research Fellow, Johannes Kepler University of Linz, Austria** Siegfried Bauer Group, Department of Soft Matter Physics

Education

2008 - 2011	**PhD (Dr. techn.) in Physics** (with highest distinction) Johannes Kepler University of Linz, Supervisor: Siegfried Bauer (Soft Matter Physics)
Sep 2009 - Mar 2010	**Visiting PhD student** Harvard University, Supervisor: Zhigang Suo (Mechanics of Materials and Structures)
2003 - 2008	**Master's & Bachelor's (Dipl.-Ing.) in Physics** (with highest distinction) Johannes Kepler University of Linz

Selected Honors, Awards and Fellowships

Oct 2019	**Young Scientist Award** (for "very significant contributions to the field of Soft Sensors, Actuators, and Robotics", International Conference on Active Materials and Soft Mechatronics, AMSM 2019)
Apr 2019	**Talk featured on TED.com:** "*The artificial muscles that will power robots of the future*" (https://www.ted.com/speakers/christoph_keplinger)
Jan 2019	**Ten robotics technologies of the year** (the HASEL technology invented in the Keplinger Research Group is selected by the editors of *Science Robotics*; DOI: 10.1126/scirobotics.aaw1826)
Dez 2018	**Speaker at TEDxMileHigh: Reset** (selected as a TEDx speaker for a live audience of 5000)
Jul 2018	**Mollenkopf Faculty Fellowship** (endowed position at the University of Colorado Boulder; awarded for outstanding research productivity)
Mar 2018	**EAP-in-Action Best Demonstration Award 2018** (awarded for best technology demo at the SPIE Smart Structures and Materials conference, the leading conference for electroactive polymers)
Oct 2017	**2017 Packard Fellowship for Science and Engineering** (one of the most prestigious awards given to early-career scientists, this $875,000.00 unrestricted award provides funding over 5 years "to think big and look at complex issues with a fresh perspective")
Jan 2014	**Postdoctoral Award for Professional Development** (from Harvard University)
Jun 2013	**EAPromising European Researcher Award** (for evidences of a promising career in the field of electroactive polymers; from the European Scientific Network for Artificial Muscles, ESNAM)
Nov 2012	**Loschmidt Award** (for outstanding dissertations; from the Chemical-Physical Society of Austria)
Oct 2012	**Erwin Wenzl Award** (for outstanding dissertations)
Dec 2011	**Award of Excellence** (from the Austrian Federal Ministry for Science and Research, BMWF)
Jul 2011	**Award for Outstanding Young Scientists** (from the Government of Upper Austria)
Sep 2009	**Marshall Plan Scholarship** (for a six-month research visit at Harvard University)

Apr 2009 **Wilhelm Macke Award + Master Thesis Prize** (best physics thesis of the year + best public presentation)
Jul 2008 **Academic Excellence Scholarship** (from the Johannes Kepler University of Linz)

Publications

Citation Indices: **Google Scholar** http://scholar.google.com/citations?user=spxYg2UAAAAJ&hl=en
ResearcherID https://publons.com/researcher/E-5553-2011/

Peer Reviewer for:
Nature, Nature Materials, Nature Communications, Science, Science Robotics, Science Advances, Chemical Reviews, Angewandte Chemie International Edition, Advanced Materials, Advanced Functional Materials, Advanced Materials Technologies, Advanced Engineering Materials, Applied Physics Reviews, Applied Physics Letters, Materials Horizons, Soft Matter, ACS Macro Letters, Applied Physics A, NPG Asia Materials, IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Industrial Electronics, IEEE Transactions on Robotics (T-RO), Energy Technology, Sustainability, Journal of Applied Physics, Smart Materials and Structures, ACS Applied Materials & Interfaces, npj Flexible Electronics, Scientific Reports, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), IEEE International Conference on Robotics and Automation (ICRA), IEEE Robotics and Automation Letters (RA-L), Extreme Mechanics Letters, Soft Robotics.

Journal Publications

[J33] Richard Baumgartner, Alexander Kogler, Josef M. Stadlbauer, Choon Chiang Foo, Rainer Kaltseis, Melanie Baumgartner, Guoyong Mao, Christoph Keplinger, Soo Jin Adrian Koh, Nikita Arnold, Zhigang Suo, Martin Kaltenbrunner, Siegfried Bauer. "A Lesson from Plants: High-Speed Soft Robotic Actuators". ***Advanced Science***, 1903391 (2020).
PDF | Supplemental

[J32] Xingrui Wang, Shane K. Mitchell, Ellen H. Rumley, Philipp Rothemund, Christoph Keplinger. "High-Strain Peano-HASEL Actuators". ***Advanced Functional Materials***, 1908821 (2019).
PDF | Supplemental | Video

[J31] Philipp Rothemund, Nicholas Kellaris, Christoph Keplinger. "How Inhomogeneous Zipping Increases the Force Output of Peano-HASEL Actuators". ***Extreme Mechanics Letters*** 31, 100542 (2019).
PDF | Supplemental

[J30] Shane K. Mitchell, Xingrui Wang, Eric Acome, Trent Martin, Khoi Ly, Nicholas Kellaris, Vidyacharan Gopaluni-Venkata, Christoph Keplinger. "An Easy-to-Implement Toolkit to Create Versatile and High-Performance HASEL Actuators for Untethered Soft Robots". ***Advanced Science*** 6 (14), 1900178 (2019).
PDF | Supplemental | Video

[J29] Nicholas Kellaris, Vidyacharan Gopaluni-Venkata, Philipp Rothemund, Christoph Keplinger. "An analytical model for the design of Peano-HASEL actuators with drastically improved performance". ***Extreme Mechanics Letters*** 29, 100449 (2019).
PDF | Supplemental

[J28] Timothy G Morrissey, Shane K Mitchell, Alexandra T Jaros, Eric Ambos, Christoph Keplinger. "Mechanical-to-Electrical Energy Conversion with Variable Electric Double Layers". ***Energy Technology*** *7* (4), 1801007 (2019).
PDF | Supplemental

[J27] Inkyu Oh, Christoph Keplinger, Jiaxi Cui, Jiehao Chen, George M. Whitesides, Joanna Aizenberg, Yuhang Hu. "Dynamically Actuated Liquid-Infused Poroelastic Film with Precise Control over Droplet Dynamics". ***Advanced Functional Materials*** 28 (39), 1802632 (2018).
PDF | Supplemental | Inside Front Cover

[J26] Nicholas Kellaris, Vidyacharan Gopaluni-Venkata, Garrett M. Smith, Shane K. Mitchell, Christoph Keplinger. "Peano-HASEL actuators: Muscle-mimetic, electrohydraulic transducers that linearly contract on activation". ***Science Robotics*** 3 (14), eaar3276 (2018). **[Web of Science "Highly Cited Paper"; top 1%]**
PDF | Supplemental | Video, Press [Covered in the world news; Altmetric score of 395 with 35 tracked stories]

[J25] Eric Acome, Shane K. Mitchell, Timothy G. Morrissey, Madison B. Emmett, Claire Benjamin, Madeline King, Miles Radakovitz, Christoph Keplinger. "Hydraulically amplified self-healing electrostatic actuators with muscle-like performance". ***Science*** 359 (6371), 61-65 (2018). **[Web of Science "Hot Paper"; top 0.1%]**
PDF | Supplemental | Video, Press [Covered in the world news; Altmetric score of 363 with 45 tracked stories]

[J24] Soo Jin Adrian Koh, Christoph Keplinger, Rainer Kaltseis, Choon-Chiang Foo, Richard Baumgartner, Siegfried Bauer, Zhigang Suo. "High-performance electromechanical transduction using laterally-constrained dielectric elastomers part I: Actuation processes". ***Journal of the Mechanics and Physics of Solids*** 105, 81-94 (2017).
PDF

[J23] Yue Cao*, Timothy G. Morrissey*, Eric Acome, Sarah I. Allec, Bryan M. Wong, Christoph Keplinger+, Chao Wang+. "A Transparent, Self-Healing, Highly Stretchable Ionic Conductor". ***Advanced Materials*** 29 (10), 1605099 (2017). (*Equal contribution; +Corresponding authors) **[Web of Science "Highly Cited Paper"; top 1%]**
PDF | Supplemental | Video, Press [Covered in the world news; Altmetric score of 320 with 42 tracked stories]

[J22] Dian Yang, Mohit S. Verma, Ju-Hee So, Bobak Mosadegh, Christoph Keplinger, Benjamin Lee, Fatemeh Khashai, Elton Lossner, Zhigang Suo, George M. Whitesides. "Buckling Pneumatic Linear Actuators Inspired by Muscle". ***Advanced Materials Technologies*** 1 (3), 1600055 (2016).
PDF | Supplemental | Press [Covered in the world news; Altmetric score of 125 with 14 tracked stories]

[J21] Cheng-Hui Li*, Chao Wang*, Christoph Keplinger, Jing-Lin Zuo, Lihua Jin, Yang Sun, Peng Zheng, Yi Cao, Franziska Lissel, Christian Linder, Xiao-Zeng You, Zhenan Bao. "A highly stretchable autonomous self-healing elastomer". ***Nature Chemistry*** 8 (6), 618-624 (2016). (*Equal contribution) **[Web of Science "Highly Cited Paper"; top 1%]**
PDF | Supplemental | Video, Press [Covered in the world news; Altmetric score of 290 with 28 tracked stories]

[J20] Joshua Lessing, Stephen A. Morin, Christoph Keplinger, Alok S. Tayi, George M. Whitesides. "Stretchable Conductive Composites Based on Metal Wools for Use as Electrical Vias in Soft Devices". ***Advanced Functional Materials*** 25 (9), 1418-1425 (2015).
PDF | Supplemental

[J19] Jeong-Yun Sun*, Christoph Keplinger*, George M. Whitesides, Zhigang Suo. "Ionic Skin". ***Advanced Materials*** 26 (45), 7608-7614 (2014). (*Equal contribution) **[Web of Science "Highly Cited Paper"; top 1%]**
PDF | Supplemental

[J18] Rainer Kaltseis, Christoph Keplinger, Soo Jin Adrian Koh, Richard Baumgartner, Yu Feng Goh, Wee Hoe Ng, Alexander Kogler, Andreas Tröls, Choon Chiang Foo, Zhigang Suo, Siegfried Bauer. "Natural rubber for sustainable high-power electrical energy generation". ***RSC Advances*** 4 (53), 27905-27913 (2014).
PDF

[J17] Joshua Lessing, Ana C. Glavan, S. Brett Walker, Christoph Keplinger, Jennifer A. Lewis, George M. Whitesides. "Inkjet Printing of Conductive Inks with High Lateral Resolution on Omniphobic "RF Paper" for Paper-Based Electronics and MEMS". ***Advanced Materials*** 26 (27), 4677-4682 (2014).
PDF | Supplemental

[J16] Ramses V. Martinez*, Ana C. Glavan*, Christoph Keplinger, Alexis I. Oyetibo, George M. Whitesides. "Soft Actuators and Robots that Are Resistant to Mechanical Damage". ***Advanced Functional Materials*** 24 (20), 3003-3010 (2014). (*Equal contribution)
PDF | Supplemental

[J15] Bobak Mosadegh, Panagiotis Polygerinos, Christoph Keplinger, Sophia Wennstedt, Robert F. Shepherd, Unmukt Gupta, Jongmin Shim, Katia Bertoldi, Conor J. Walsh, George M. Whitesides. "Pneumatic Networks for Soft Robotics that Actuate Rapidly". ***Advanced Functional Materials*** 24 (15), 2163-2170 (2014).
[Web of Science "Highly Cited Paper"; top 1%]
PDF | Supplemental | Front Cover

[J14] Tongqing Lu, Christoph Keplinger, Nikita Arnold, Siegfried Bauer, Zhigang Suo. "Charge localization instability in a highly deformable dielectric elastomer". ***Applied Physics Letters*** 104 (2), 022905 (2014).
PDF

[J13] Siegfried Bauer*, Simona Bauer-Gogonea*, Ingrid Graz*, Martin Kaltenbrunner*, Christoph Keplinger*, Reinhard Schwoediauer*. "25th Anniversary Article: A Soft Future: From Robots and Sensor Skin to Energy Harvesters". ***Advanced Materials*** 26 (1), 149-162 (2014). (*Equal contribution)
[Web of Science "Highly Cited Paper"; top 1%]
PDF | Review Article

[J12] Andreas Tröls, Alexander Kogler, Richard Baumgartner, Rainer Kaltseis, Christoph Keplinger, Reinhard Schwödiauer, Ingrid Graz, Siegfried Bauer. "Stretch dependence of the electrical breakdown strength and dielectric constant of dielectric elastomers". ***Smart Materials and Structures*** 22 (10), 104012 (2013).
PDF

[J11] Christoph Keplinger*, Jeong-Yun Sun*, Choon Chiang Foo, Philipp Rothemund, George M. Whitesides, Zhigang Suo. "Stretchable, Transparent, Ionic Conductors". ***Science*** 341 (6149), 984-987 (2013). (*Equal contribution)
[Web of Science "Highly Cited Paper"; top 1%]
PDF | Supplemental | Video, Perspective by John A. Rogers, Press [Covered in the world news; Altmetric score of 214 with 23 tracked stories]

[J10] Tiefeng Li, Christoph Keplinger, Richard Baumgartner, Siegfried Bauer, Wei Yang, Zhigang Suo. "Giant voltage-induced deformation in dielectric elastomers near the verge of snap-through instability". ***Journal of the Mechanics and Physics of Solids*** 61 (2), 611-628 (2013). **[Web of Science "Highly Cited Paper"; top 1%]**
PDF

[J9] Choon Chiang Foo, Soo Jin Adrian Koh, Christoph Keplinger, Rainer Kaltseis, Siegfried Bauer, Zhigang Suo. "Performance of dissipative dielectric elastomer generators". ***Journal of Applied Physics*** 111 (9), 094107 (2012).
PDF

[J8] Qibin Zhao, Andrew Haines, David Snoswell, Christoph Keplinger, Rainer Kaltseis, Siegfried Bauer, Ingrid Graz, Richard Denk, Peter Spahn, Goetz Hellmann, Jeremy J. Baumberg. "Electric-field-tuned color in photonic crystal elastomers". ***Applied Physics Letters*** 100 (10), 101902 (2012).
PDF

[J7] Christoph Keplinger, Tiefeng Li, Richard Baumgartner, Zhigang Suo, Siegfried Bauer. "Harnessing snap-through instability in soft dielectrics to achieve giant voltage-triggered deformation". ***Soft Matter*** 8 (2), 285-288 (2012).
PDF | Front Cover

[J6] Soo Jin Adrian Koh, Christoph Keplinger, Tiefeng Li, Siegfried Bauer, Zhigang Suo. "Dielectric elastomer generators: How much energy can be converted?". ***IEEE/ASME Transactions on Mechatronics*** 16 (1), 33-41 (2011).
[Web of Science "Highly Cited Paper"; top 1%]
PDF

[J5] Rainer Kaltseis, Christoph Keplinger, Richard Baumgartner, Martin Kaltenbrunner, Tiefeng Li, Philipp Maechler, Reinhard Schwoediauer, Zhigang Suo, Siegfried Bauer. "Method for measuring energy generation and efficiency of dielectric elastomer generators". ***Applied Physics Letters*** 99 (16), 162904 (2011).
PDF

[J4] Christoph Keplinger, Martin Kaltenbrunner, Nikita Arnold, Siegfried Bauer. "Roentgen's electrode-free elastomer actuators without electromechanical pull-in instability". ***Proceedings of the National Academy of Sciences of the United States of America*** 107 (10), 4505-4510 (2010).
PDF | Supplemental

[J3] Christoph Keplinger, Martin Kaltenbrunner, Nikita Arnold, Siegfried Bauer. "Capacitive extensometry for transient strain analysis of dielectric elastomer actuators". ***Applied Physics Letters*** 92 (19), 192903 (2008).
PDF

[J2] Christian Metzger, Elgar Fleisch, Jan Meyer, Mario Dansachmueller, Ingrid Graz, Martin Kaltenbrunner, Christoph Keplinger, Reinhard Schwödiauer, Siegfried Bauer. "Flexible-foam-based capacitive sensor arrays for object detection at low cost". ***Applied Physics Letters*** 92 (1), 013506 (2008).
PDF

[J1] Ingrid Graz, Martin Kaltenbrunner, Christoph Keplinger, Reinhard Schwoediauer, Siegfried Bauer, Stephanie P. Lacour, Sigurd Wagner. "Flexible ferroelectret field-effect transistor for large-area sensor skins and microphones". ***Applied Physics Letters*** 89 (7), 073501 (2006).
PDF | Front Cover

Conference Publications

[C12] Shardul Panwar, Umesh Gandhi, Eric Acome, Christoph Keplinger, Michael Rowe. (2019). Simulation-driven design to reduce pull-in voltage of donut HASEL Actuators. Electroactive Polymer Actuators and Devices (EAPAD) Conference XXI 10966, 1096622.

[C11] J. McMahon, S. K. Mitchell, K. Oguri, N. Kellaris, D. Kuettel, C. Keplinger, B. Bercovici. (2019). Area-of-Effect Softbots (AoES) for Asteroid Proximity Operations. IEEE Aerospace Conference, 1-16.

[C10] C. Schunk, L. Pearson, E. Acome, T.G. Morrissey, N. Correll, C. Keplinger, M.E. Rentschler, J.S. Humbert. (2018). System Identification and Closed-Loop Control of a Hydraulically Amplified Self-Healing Electrostatic (HASEL) Actuator. 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 978-1-5386-8094-0, 6417-6423.

[C9] T. Li, S. Qu, C. Keplinger, R. Kaltseis, R. Baumgartner, S. Bauer, Z. Suo, W. Yang. (2012). Modeling guided design of dielectric elastomer generators and actuators. *Electroactive Polymer Actuators and Devices (EAPAD) 2012, Proceedings of the SPIE* 8340, 83401X.

[C8] T. Li, S. Qu, C. Keplinger, Z. Suo, W. Yang. (2012). Inhomogeneous deformation and instability in soft dielectric transducers. *Bulletin of the American Physical Society*, BAPS.2012.MAR.X49.1.

[C7] R. Baumgartner, C. Keplinger, R. Kaltseis, R. Schwödiauer, S. Bauer. (2011). Dielectric elastomers: From the beginning of modern science to applications in actuators and energy harvesters. *Electroactive Polymer Actuators and Devices (EAPAD) 2011, Proceedings of the SPIE* 7976, 797603.

[C6] M. Kaltenbrunner, C. Keplinger, N. Arnold, S. Bauer. (2010). Electrode Free Elastomer Actuators with Unlimited Actuation Range. *Actuator 10, Conference Proceedings*, 427.

[C5] T. Li, C. Keplinger, L. Liu, R. Baumgartner, S. Qu. (2010). Modeling of Inhomogeneous Deformation in a Dielectric Elastomer Generator for Energy Harvesting. *ASME 2010 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Volume 1, SMASIS2010* 3792, 267.

[C4] R. Schwoediauer, I. Graz, M. Kaltenbrunner, C. Keplinger, P. Bartu, G. Buchberger, C. Ortwein, S. Bauer. (2008). Cellular ferroelectrets for soft matter integrated devices with advanced functionality. *2008 13th International Symposium on Electrets. ISE 13*, B1203.

[C3] M. Kaltenbrunner, C. Keplinger, N. Arnold, S. Bauer. (2008). Analysis of safe and failure mode regimes of dielectric elastomer actuators. *Sensors, 2008 IEEE*, 156.

[C2] R. Schwoediauer, I. Graz, M. Kaltenbrunner, C. Keplinger, P. Bartu, G. Buchberger, C. Ortwein, S. Bauer. (2008). Cellular ferroelectrets for electroactive polymer hybrid systems: soft matter integrated devices with advanced functionality. *Electroactive Polymer Actuators and Devices (EAPAD) 2008, Proceedings of the SPIE* 6927, 69270Q-69270Q-10.

[C1] S. Bauer, S. Bauer-Gogonea, M. Dansachmueller, G. Dennler, I. Graz, R. Schwoediauer, C. Keplinger, H. Reiss, N. Sariciftci, B. Singh, M. Kaltenbrunner. (2006). Piezoelectric polymers. *Materials Research Society Symposium Proceedings* 889, 0889-W01-02.1.

Other Publications

[O9] Eric Acome, Nicholas Kellaris, Timothy Morrissey, Shane K. Mitchell, Christoph Keplinger. (2018). HASEL Artificial Muscles – Versatile High-performance Actuators for Next-Generation Robotics. NASA JPL (NDEAA Lab) WorldWide ElectroActive Polymers Newsletter 20 (1), 19.

[O8] Eric Acome, Nicholas Kellaris, Timothy Morrissey, Shane K. Mitchell, Christoph Keplinger. (2018). Journal Club for February 2018: HASEL artificial muscles for high-speed, electrically powered, self-healing soft robots. iMechanica Journal Club, http://imechanica.org/node/22096

[O7] Yue Cao, Timothy G. Morrissey, Eric Acome, Sarah I. Allec, Bryan M. Wong, Christoph Keplinger, Chao Wang. (2017). A Transparent, Self-Healing, Highly Stretchable Ionic Conductor. NASA JPL (NDEAA Lab) WorldWide ElectroActive Polymers Newsletter 19 (1), 16.

[O6] Christoph Keplinger. (2011). Electromechanical Energy Conversion Using Dielectric Elastomers: Giant Voltage-Induced Deformation of Actuation and Renewable Energy Harvesting. *PhD Thesis (Dissertation)*, Johannes Kepler University of Linz. [Supervisor: Siegfried Bauer (Soft Matter Physics)]

[O5] Siegfried Bauer, Christoph Keplinger. (2011). Dielectric-elastomer actuators deliver clean energy. *SPIE Newsroom,* DOI: 10.1117/2.1201102.003511. [http://spie.org/x47448.xml]

[O4] Christoph Keplinger, Tiefeng Li, Richard Baumgartner, Zhigang Suo, Siegfried Bauer. (2011). Harnessing snap-through instability in soft dielectrics to achieve giant voltage-triggered deformation. *NASA JPL (NDEAA Lab) WorldWide ElectroActive Polymers Newsletter* 13 (2), 9.

[O3] Christoph Keplinger, Martin Kaltenbrunner, Nikita Arnold, Siegfried Bauer. (2010). What can we learn by repeating the old experiment of Roentgen on charge controlled actuators? *NASA JPL (NDEAA Lab) WorldWide ElectroActive Polymers Newsletter* 12 (1), 13.

[O2] Christoph Keplinger, Martin Kaltenbrunner, Nikita Arnold, Siegfried Bauer. (2008). Electrical control method for dielectric elastomer actuators. *NASA JPL (NDEAA Lab) WorldWide ElectroActive Polymers Newsletter* 10 (1), 10.

[O1] Martin Kaltenbrunner, Christoph Keplinger. (2008). Dielektrische Elastomer Aktuatoren. *Master's Thesis (Diplomarbeit)*, Johannes Kepler University of Linz. [Supervisor: Siegfried Bauer (Soft Matter Physics)]

Patents

[P8] Christoph Keplinger, Xingrui Wang, Shane K. Mitchell. "**High Strain Peano Hydraulically Amplified Self-Healing Electrostatic (HASEL) Transducers**", Provisional filed, U.S. Provisional Patent App. 62/946,317.

[P7] Shane K. Mitchell, Eric L. Acome, Christoph Keplinger. "**Hydraulically amplified self-healing electrostatic (HASEL) pumps**", Provisional filed, U.S. Provisional Patent App. 62/886,820.

[P6] Christoph Keplinger, Eric L. Acome, Nicholas A. Kellaris, Shane K. Mitchell, Ellen Rumley, Philipp Rothemund. "**Foldable filling fabrication and composite layering of hydraulically amplified self-healing electrostatic transducers**", Provisional filed, U.S. Provisional Patent App. 62/813,266.

[P5] Christoph Keplinger, Eric L. Acome, Nicholas A. Kellaris, Shane K. Mitchell, Timothy G. Morrissey. "**Hydraulically amplified self-healing electrostatic transducers harnessing zipping mechanism**", PCT filed, PCT/US19/020568.

[P4] Christoph Keplinger, Eric L. Acome, Nicholas A. Kellaris, Shane K. Mitchell, Madison B. Emmett. "**Hydraulically amplified self-healing electrostatic transducers**", WO 2018/175741 A1.

PDF

[P3] Joshua A. Lessing, Ana C. Glavan, S. Brett Walker, Christoph Keplinger, George M. Whitesides. **"Cellulose and Cellulosic Substrate-Based Device"**, WO 2015/160684 A1.
PDF

[P2] Jeong-Yun Sun, Christoph Keplinger, Zhigang Suo, George M. Whitesides. **"Stretchable Ionics for Transparent Sensors and Actuators"**, WO 2014/169119 A1.
PDF

[P1] Siegfried Bauer, Ingrid Graz, Reinhard Schwoediauer, Christoph Keplinger, Martin Kaltenbrunner, Stephanie Lacour Perichon, Sigurd Wagner. **"Ferrous Component"**, WO 2007/085035 A2.
PDF

Invited & Keynote Talks

Upcoming events:

[T35] 2020 MRS Fall Meeting, 2020, Boston, Massachusetts, USA: TBD.
[Invited talk]

[T34] CIMTEC 2020 - 15th International Ceramics Congress & 9th Forum on New Materials, 2020, Montecatini Terme, Italy: TBD.
[Invited talk]

[T33] 2020 Symposium on Mechanics of Smart and Tough Gels – International Union of Theoretical and Applied Mechanics (IUTAM), 2020, Austin, Texas, USA: TBD.
[Invited talk]

[T32] 2020 MRS Spring Meeting, 2020, Phoenix, Arizona, USA: TBD.
[Invited talk]

[T31] BioEl2020 International Winterschool on Bioelectronics, 2020, Kirchberg in Tirol, Austria: TBD.
[Invited talk]

[T30] University of Rochester – Department of Physics and Astronomy Colloquium, 2020, Rochester, New York, USA: TBD.
[Invited talk]

Past events:

[T29] The 4th International Conference on Active Materials and Soft Mechatronics (AMSM), 2019, Incheon, Korea: HASEL artificial muscles.
[Keynote Lecture]

[T28] Max Planck Institute for Intelligent Systems – Institute Colloquium, 2019, Stuttgart, Germany: Robotic materials for the intelligent systems of the future: From soft robotics to energy capture.
[Invited talk]

[T27] The Hamlyn Symposium on Medical Robotics, 2019, London, UK: Artificial Muscles for a New Generation of Lifelike Robots.
[Invited talk]

[T26] Summer School on Soft Robotics, Biomechanics and Advanced Human Machine Interaction, 2019, Dresden, Germany: Artificial muscles for a new generation of lifelike soft robots.
[Invited talk]

[T25] TU Dresden, B CUBE - Center for Molecular Bioengineering, Institute Seminar, 2019, Dresden, Germany: Artificial muscles for a new generation of lifelike robots.
[Invited talk]

[T24] EuroEAP 2019 – Ninth international conference on Electromechanically Active Polymer (EAP) transducers & artificial muscles, 2019, Dresden, Germany: HASEL artificial muscles.
[Invited talk]

[T23] Distinguished Lecture Series at Ecole Polytechnique Federale de Lausanne (EPFL), School of Engineering (IMT), 2019, Lausanne, Switzerland: HASEL Artificial Muscles - Versatile High-Performance Actuators for a New Generation of Life-like Robots.
[Invited talk; *Distinguished lecturer invitation is "only considered for the most highly recognized researchers and is established by recommendation only, a sign of the highest respect for your research activities among the experts in your field"*]

[T22] Northwestern University - Physics Department Colloquium, 2019, Evanston, Illinois, USA: Artificial muscles for a new generation of lifelike robots.
[Invited talk]

[T21] MIT Robotics Seminar, 2018, Boston, Massachusetts, USA: HASEL Artificial Muscles—Versatile High-Performance Actuators for a New Generation of Life-like Robots.
[Invited talk]

[T20] 2018 MRS Fall Meeting, 2018, Boston, Massachusetts, USA: HASEL Artificial Muscles—Versatile High-Performance Actuators for Next-Generation Robotics.
[Invited talk]

[T19] Max Planck Institute for Intelligent Systems – Special Symposium on Intelligent Systems, 2018, Stuttgart, Germany: Intelligent Materials for a New Generation of life-like Robots.
[Keynote talk]

[T18] Packard Fellows 30th Anniversary Reunion, 2018, San Diego, California, USA: HASEL Artificial Muscles – Versatile High-Performance Actuators for Next-Generation Robotics.
[Invited talk]

[T17] International Union of Materials Research Societies – International Conference on Electronic Materials 2018 (IUMRS-ICEM 2018), 2018, Daejeon, Korea: Hydraulically Amplified Self-healing ELectrostatic (HASEL) transducers: A new class of high-performance soft actuators.
[Invited talk]

[T16] 2018 MRS Spring Meeting, 2018, Phoenix, Arizona, USA: Hydraulically Amplified Self-Healing ELectrostatic (HASEL) Transducers—A New Class of Self-Sensing, High-Performance Artificial Muscles.
[Invited talk]

[T15] Invited Seminar, Department of Mechanical Engineering, Colorado State University, 2017, Fort Collins, Colorado, USA: Hydraulically Amplified Self-healing ELectrostatic (HASEL) actuators: A new class of high-performance artificial muscles
[Invited talk]

[T14] Invited Seminar, Department of Mechanical Engineering, National University of Singapore, 2017, Singapore: Hydraulically Amplified Self-Healing ELectrostatic (HASEL) Actuators: High-Performance Muscle-Mimetic Transducers
[Invited talk]

[T13] 9th International Conference on Materials for Advanced Technologies (ICMAT 2017, Symposium R, Wearable and Stretchable Electronics), 2017, Singapore:
High Performance, Electrically Powered, Soft Actuators that Self-Heal.
[Invited talk]

[T12] 9th International Conference on Materials for Advanced Technologies (ICMAT 2017, Symposium J, Transparent Electrode Materials and Devices), 2017, Singapore:
Stretchable Ionics: From Transparent Artificial Muscles and Biocompatible Ionic Skin to Self-Healing Systems.
[Invited talk]

[T11] SPIE Smart Structures/NDE, Electroactive Polymer Actuators and Devices (EAPAD) XIX, 2017, Portland, Oregon, USA: Reliable, robust, electrically powered soft actuators that self-heal from mechanical and electrical damage.
[Invited talk]

[T10] 2nd UMD Workshop on Distributed Sensing, Actuation, and Control for Bio-inspired Soft Robotics, 2016, College Park, Maryland, USA:
Stretchable Ionics: From Transparent Artificial Muscles and Biocompatible Ionic Skin to Self-Healing Systems.
[Invited talk]

[T9] 2016 MRS Spring Meeting, 2016, Phoenix, Arizona, USA:
Stretchable Ionics: From Transparent Artificial Muscles to Biocompatible Ionic Skin.
[Invited talk]

[T8] 2015 MICACT Training School on Dielectric Elastomer Transducers, 2015, EPFL, Neuchâtel, Switzerland:
Stretchable Ionics: Perfectly Transparent Artificial Muscles, Loudspeakers and Ionic Skin.
[Invited talk]

[T7] 581. Wilhelm und Else Heraeus-Seminar on Flexible, Stretchable and Printable High Performance Electronics, 2015, Bad Honnef, Germany:
Stretchable Ionics: Perfectly Transparent Artificial Muscles, Loudspeakers and Ionic Skin.
[Invited talk]

[T6] Ludwig Boltzmann Institute for Experimental and Clinical Traumatology, Institute Colloquium, 2014, Vienna, Austria:
Stretchable Ionics: Perfectly Transparent Artificial Muscles, Loudspeakers and Ionic Skin.
[Invited talk]

[T5] SPIE Smart Structures/NDE, Electroactive Polymer Actuators and Devices (EAPAD) XVI, 2014, San Diego, USA:
Stretchable Ionics: Perfectly Transparent Artificial Muscles, Loudspeakers and Ionic Skin.
[Invited talk]

[T4] Stanford University, Mechanics and Computation Seminar, 2014, Stanford, USA:
Soft Machines: From Artificial Muscles and Renewable Energy to Stretchable Ionics and Bionic Skin.
[Invited talk]

[T3] EuroEAP 2013, Third international conference on Electromechanically Active Polymer (EAP) transducers & artificial muscles, 2013, Zurich, Switzerland:
Giant deformation of elastomers in electric fields.
[Invited talk; *Part of the "EAPromises Session" for young researchers with evidences of a promising career*]

[T2] Lecture Series of the Chemical-Physical Society of Austria, 2013, Vienna, Austria:
Elastomers in the Electric Field: Giant-Strain Actuators and Renewable Energy Harvesting.
[Invited talk; *Introduction of recipients of the Loschmidt Award*]

[T1] ASME 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS), 2012, Stone Mountain, USA:
Dielectric Elastomers for Giant Voltage-Induced Deformation of Actuation and Renewable Energy Harvesting.
[Invited talk]

Selected Public Talks for Broader Audiences

[PT3] ”Land der Moeglichkeiten” (German for ”A region of opportunity”) – large public event to discuss the future of Upper Austria, 2019, Linz, Austria: Artificial muscles for a new generation of lifelike robots.
[Keynote talk for a live audience of over 1000; invited by the Governor of Upper Austria; also attended by the Chancellor of Austria]

[PT2] TEDxMileHigh: “Reset”, 2018, Denver, Colorado, USA: Artificial muscles for a new generation of lifelike robots.
[TEDx talk for live audience of 5000]

[PT1] CU on the Weekend (public lecture series), 2017, Boulder, Colorado, USA: How Renewable Technologies can Transform Energy.
[Invited public lecture]

Selected Conference Awards

[CA1] SPIE Smart Structures/NDE, Electroactive Polymer Actuators and Devices (EAPAD) XX, 2018, Denver, Colorado, USA: HASEL: Hydraulically amplified self-healing electrostatic actuators with muscle-like performance (*Live demo of the HASEL technology invented in the Keplinger Research Group*).
[Awarded with best of conference award: “EAP-in-Action Best Demonstration Award 2018”]

Other Conference Presentations

[CP8] Gordon Research Conference - Multifunctional Materials and Structures, 2018, Ventura, California, USA:
Hydraulically Amplified Self-healing ELectrostatic (HASEL) actuators: A new class of high-performance artificial muscles.

[CP7] 2017 MRS Spring Meeting, 2017, Phoenix, Arizona, USA:
High Performance, Electrically Powered, Soft Actuators that Self-Heal.

[CP6] SPIE Smart Structures/NDE, Electroactive Polymer Actuators and Devices (EAPAD) XIV, 2012, San Diego, USA:
Energy harvesting with dielectric elastomer generators based on natural rubber.

[CP5] SPIE Smart Structures/NDE, Electroactive Polymer Actuators and Devices (EAPAD) XIII, 2011, San Diego, USA:
Inflation of dielectric elastomer membranes for energy harvesting: prestretch, rupture, dielectric breakdown, and the electromechanical instability.

[CP4] 2010 MRS Spring Meeting, 2010, San Francisco, USA:
Aptitude of Dielectric Elastomer Transducers for Energy Harvesting Generators.

[CP3] 2009 MRS Spring Meeting, 2009, San Francisco, USA:
The Roentgen Experiment - A Historical Idea Opening up Interesting Possibilities for Dielectric Elastomer Actuator Design and Material Characterization.

[CP2] IEEE Sensors 2008, 2008, Lecce, Italy:
Analysis of safe and failure mode regimes of dielectric elastomer actuators.

[CP1] Winterschool on Organic Electronics, 2007, Planneralm, Austria:
Multifunctional ferroelectric polymer – piezoelectric ceramic nano-composites for flexible skin-like electronics.

Teaching

New Course Development

MCEN4064/5064: Soft Machines – Introduces soft machines as a new paradigm of engineering that starts to impact healthcare, consumer electronics, renewable energy and collaborative robotics. Prepares students to participate in research on soft machines by starting with fundamentals of soft materials and by covering soft robotics, stretchable electronics, energy harvesting and functional polymers. Includes guest lectures, a literature review and a hands-on lab project.
[New course for graduate students and senior undergraduate students]

Teaching at the University of Colorado Boulder:

Spring 2020	**Mechanical Engineering Design Project 2** (MCEN-4085)
Fall 2019	**Soft Machines** (MCEN-4064 and 5064) Teaching evaluation: **Instructor overall: 5.4/6.0**, **Course overall: 5.2/6.0**
Fall 2019	**Mechanical Engineering Design Project 1** (MCEN-4045)
Fall 2018	**Soft Machines** (MCEN-4064 and 5064) Teaching evaluation: **Instructor overall: 5.6/6.0**, **Course overall: 5.4/6.0**
Spring 2018	**Mechanical Engineering Design Project 2** (MCEN-4085) Teaching evaluation: **Instructor overall: 5.8/6.0**, **Course overall: 5.8/6.0**
Fall 2017	**Mechanical Engineering Design Project 1** (MCEN-4045)
Fall 2017	**Engineering Projects** (GEEN-1400) Teaching evaluation: **Instructor overall: 5.7/6.0**, **Course overall: 5.4/6.0**
Spring 2017	**Special Topics in Mechanical Engineering: Soft Machines** (MCEN-5228) Teaching evaluation: **Instructor overall: 6.0/6.0**, **Course overall: 5.8/6.0**
Fall 2016	**Engineering Projects** (GEEN-1400) Teaching evaluation: **Instructor overall: 5.6/6.0**, **Course overall: 5.3/6.0**
Spring 2016	**Special Topics in Mechanical Engineering: Soft Machines** (MCEN-5228) Teaching evaluation: **Instructor overall: 5.8/6.0**, **Course overall: 5.5/6.0**
Fall 2015	**Engineering Projects** (GEEN-1400) Teaching evaluation: **Instructor overall: 5.8/6.0**, **Course overall: 5.6/6.0**

Teaching prior to joining the faculty at Boulder:

Mar 2009 - Jun 2009	Lecturer of **Polymer Physics Exercises**, Johannes Kepler University of Linz.
Mar 2006 - Jan 2009	Tutorials for the courses **Experimental Physics I-IV**, Tutorial for the course **Physics in Biological Chemistry**, Tutorial for the course **Physics for Mechatronics Engineers**, Laboratory tutorial **Soft Matter Physics I**, all at the Johannes Kepler University of Linz.
2002 - 2008	**Private lessons** for high school students in mathematics, physics and Latin; **Course instructor at summer schools** (high school level) in mathematics and Latin.

Advising and Mentoring

- For additional details (such as CV or LinkedIn profile) on currently advised postdocs, PhD students, MS students, visiting scholars and undergraduate students, as well as group alumni, see: http://www.keplingerresearchgroup.com/people

Postdocs

Dr. Timothy Morrissey — May 2019 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder, 2019

Dr. Philipp Rothemund — Jan 2019 – Present
Ph.D. Engineering Sciences, Harvard University, 2018

Visiting Scholars

Xingrui Wang — Jan 2018 – Present
Visiting PhD student from Tongji University, Shanghai, China

Fanny Ho — Aug 2019 – Jan 2020
Visiting student (Bachelor Thesis) from Nanyang Technological University, Singapore

Artemii Goshkoderia — Sep 2017 – Nov 2017
Visiting PhD student from Technion - Israel Institute of Technology, Haifa, Israel

Ph.D. Students

Zachary Yoder — Aug 2019 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder
Anticipated graduation: Fall 2024

Hyeong-Joon Joo — Aug 2019 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder
Anticipated graduation: Fall 2024

Ingemar Schmidt — Jul 2019 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder
Anticipated graduation: Fall 2024

Sophie Kirkman — Jul 2019 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder
Anticipated graduation: Fall 2024

Gavriel Kleinwaks — Sep 2018 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder
Anticipated graduation: Fall 2023

Ellen Rumley — Aug 2018 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder
Anticipated graduation: Fall 2023

Nicholas Kellaris — Jan 2016 – Present
Ph.D. Materials Science & Engineering, University of Colorado Boulder
Anticipated graduation: Fall 2020

Shane Mitchell — Nov 2015 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder
Anticipated graduation: Fall 2020

Eric Acome — Sep 2015 – Present
Ph.D. Mechanical Engineering, University of Colorado Boulder
Anticipated graduation: Spring 2020

Timothy Morrissey — Aug 2013 – May 2019
Ph.D. Mechanical Engineering, University of Colorado Boulder
Graduated: May 2019
Thesis: "*Ionic Systems for Electromechanical Transducers:*

Energy Harvesting and Soft Robotics"

M.S. Students (Thesis students)

Eric Ambos — Aug 2015 – May 2017
M.S. Mechanical Engineering, University of Colorado Boulder
Graduated: May 2017
Thesis: "*Utilizing Variable Electric Double Layer Capacitors for High Performance Mechanical to Electrical Energy Conversion*"

M.S. Students (Non-thesis students)

Matt McClelland	2018 – Present
Aniya Khalili	2018 – 2019
Thomas Lund	2018 – 2019
Grant McElhany	2017 – 2019
Vidyacharan (VC) Gopaluni Venkata	2016 – 2018
Claire Benjamin	2015 – 2017

Undergraduate Research Associates

Yi Zheng	2019 – Present
Christina Chase-Markopoulou	2017 – Present
Trent Martin	2017 – Present
Garrett Smith	2016 – 2019
Charles Bright	2019 – 2019
Eliza Beisher	2018 – 2018
Ethan Harrington	2018 – 2018
Alexandra Jaros	2017 – 2018
Miles Radakovitz	2016 – 2018
Madeline King	2016 – 2018
Madison Emmett	2016 – 2018
Nicholas Kurtyka	2016 – 2017

Professional Service in Conference Committees, Symposia Organized and other Selected Service

- ⇨ Regularly serving as session chair in attended conferences, and as student mentor in networking events.
- ⇨ Peer reviewer for extensive list of journals, see page 2; regular reviewer of grant proposals.

[PS6] The iMechanica Journal Club, https://imechanica.org/jclub; iMechanica is the "web of mechanics and mechanicians" and features monthly discussion topics on new research directions, identified by the editor.
[Selected as Editor for 2019-2020]

[PS5] ACTUATOR 2020, International Conference and Exhibition on New Actuator Systems and Applications, 2020, Mannheim, Germany
[Member of Conference Program Committee]

[PS4] SPIE Smart Structures/NDE, Electroactive Polymer Actuators and Devices (EAPAD) XXII, 2020, Anaheim, California, USA
[Member of Conference Program Committee]

[PS3] 2017 MRS Spring Meeting, 2017, Phoenix, Arizona, USA
[Symposium organizer of Symposium SM4: "A Soft Future—From Electronic Skin to Robotics and Energy Harvesting"]

[PS2] SES2016, The 53rd Annual Technical Meeting of the Society of Engineering Science (SES), 2016, College Park, Maryland, USA
[Organizer of Symposium C-11: "Mechanics of Bioinspired Soft Machines"]

[PS1] ASME 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS), 2012, Stone Mountain, USA
[Session organizer for "Multifunctionality of Electronic Electroactive Polymers"]

University Service

Department of Mechanical Engineering, University of Colorado Boulder

Spring 2020	External Relations Committee
Fall 2019	External Relations Committee
Spring 2019	Graduate Committee
Fall 2018	Graduate Committee
Spring 2018	External Relations Committee
Fall 2017	External Relations Committee
Spring 2017	Faculty Search Committee; Undergraduate Committee
Fall 2016	Faculty Search Committee; Undergraduate Committee; Examiner Solid Mechanics Prelims
Spring 2016	Faculty Search Committee; Graduate Committee; Organizer of Department Seminar Series
Fall 2015	Faculty Search Committee; Graduate Committee

University of Colorado Boulder

- **Faculty Mentor for the Undergraduate Research Opportunities Program (UROP)**
  Mentored students: Eliza Beisher (2018-19 Academic Year), Madison Emmett (2017-18 Academic Year), Alexandra Jaros (2017-18 Academic Year), Madeline King (2017-18 Academic Year), Miles Radakovitz (2017-18 Academic Year), Madison Emmett (2017 Summer), Alexandra Jaros (2017 Summer), Trent Martin (2017 Summer), Garrett Smith (2017 Summer)
- **Packard Fellows Committee to select university nominees for Packard Fellowships for Science and Engineering**
  Fall 2017 – Present
- **Panelist for Research & Innovation Office (RIO) faculty workshops on Packard Fellowship Awards**
  Fall 2018 – Present

Skills and Interests

- **Languages:** German (native), English (fluent), Latin (very good), Russian (good), French (good), Spanish (basic).
- **Photography, badminton, violin**