

Ronan Hinchet

Functional Materials and NEMS Researcher for Soft Transducers and Wearable Robotics

RESEARCH EXPERIENCE

- present - **Eidgenössische Technische Hochschule Zurich (ETHZ)**, SRL lab, Zurich (CH)
- **2021 Senior researcher (subgroup leader)**, research on active and architected materials for robotics
Research on robotic devices: architected materials with programmable mechanical properties and integrated sensing, actuation, and communication structures. Modelling of robotic materials, experimental analysis and validation.
- 2021 École Polytechnique Fédérale de Lausanne (EPFL)**, LMTS lab, Neuchatel (CH)
- **2017 Researcher (Postdoc)**. research on soft wearable actuators for haptics
Developed soft electrostatic clutches for VR, robotics and healthcare applications. Developed soft, wearable, textile and skin patch integrations. Evaluated various wearable tactile actuators based on electromagnetic and electrostatic physics. Conducted user tests in VR.
- 2017 Sungkyunkwan University (SKKU)**, NESEL lab, Suwon (KR)
- **2014 Researcher (Postdoc)**. research on mechanical energy harvesters, sensors and 2D materials
Created energy harvesters based on triboelectric and electret polymer thin films, and piezoelectric 2D materials. Integrated wearable & implantable energy harvesters. Coordinated interdisciplinary and international collaborations. Supervised Master & Ph.D. students.
- 2014 Institut national polytechnique de Grenoble (INPG)**, IMEP-LAHC lab, Grenoble (FR)
- **2010 Ph.D.** development of mechanical energy harvesters based on piezoelectric nanostructures
Developed the modelling, fabrication, characterization and integration of semiconductor piezoelectric nanowire for energy harvesting. Advised graduate students in internships. Established locals and one international collaboration. Discovered research in micro and nanotechnologies fields.
- 2013 Georgia Institute of Technology (GT)**, Nanoscience Research Group, Atlanta (US)
- **2012 Ph.D. exchange**. Materials Science and Engineering: piezoelectric nanowire based generator
International research exchange to learn the growth and integration of ZnO nanowires. Teach the modelling and characterization of NWs. Optimization of NEMS devices. Team integration.
- 2010 Institut national polytechnique de Grenoble (INPG)**, IMEP-LAHC lab, Grenoble (FR)
- Eng. & Ms. Thesis**. Electromechanical characterization of nano switches
Characterization and optimization of micro switches in collaboration with Stanford University. Design and fabrication of equipment for custom experiments on probe station and AFM. Discovered MEMS R&D

EDUCATION

- **2010-2014 Ph.D. at IMEP-LAHC lab, EEATS school, INPG, Grenoble, FR**
Ph.D. in Nano Electronic and Nano Technologies. Thesis on "Electromechanical study of semiconductor piezoelectric nanowires. Application to mechanical sensors and energy harvesters". (def. 04/04/2014)
- **2012-2013 at Nanoscience Research Group, Georgia Institute of Technology, Atlanta, US**
Ph.D. exchange in Materials Science and Engineering.
- **2009-2010 M.Phys. at University Joseph Fourier, Grenoble, FR**
M.Phys. in Micro and Nano Electronics.
- **2007-2010 M.Eng. at PHELMA school, INPG, Grenoble, FR**
M.Eng. in Microelectronics for Integrated systems. Master thesis on "Electromechanical study and characterization of NEMS nano-switches".
- **2008-2009 Exchange at École Polytechnique de Montréal, Montreal, CA**
Exchange in Microelectronics and Microfabrication. (60 ECTS cr.).
- **2003-2007 B.Sc. at ENSERG school, INPG, Grenoble, FR**
B.Sc. in Engineering Sciences.

TEACHING & MENTORING

- present** **TA at Eidgenössische Technische Hochschule Zurich (ETHZ)**, SRL lab, Zurich (CH)
- 2022** Teaching Assistant for the master class “263-3712-00L Advanced Seminar on Computational Haptics of Professor Otmar Hilliges.
Tasks: supervise students’ preparation for the seminar, guide the class and give expertise in haptic
- 2021** **TA at École Polytechnique Fédérale de Lausanne (EPFL)**, LMTS lab, Neuchatel (CH)
- 2017** Teaching Assistant for the under graduate class “MICRO-102 Statique et Dynamique” and then “MICRO-200 Conception de mécanismes 1” of Professor Herbert Shea during 3 years.
Tasks: prepare and give exercise series, write new exams, watch and correct midterms and final
- 2017** **Student advisor at Sungkyunkwan University (SKKU)**, NESEL lab, Suwon (KR)
- 2014** Supervised 3 graduate students and advised 5 Ph.D. in the lab.
Gave scientific and technical supports to the lab’s students under the responsibility of Professor Sang-Woo Kim: research guidance, publication advise, multi-physics and electric simulations training, electronic measurements quality control, and AFM advising
- 2012** **Local AFM consultant at Grenoble INP**, IMEP-LAHC lab, Grenoble (FR)
Gave Atomic Force Microscopy (AFM) training to researchers and students under the responsibility of Professor Gustavo Ardila. Training on the Kelvin Probe and Piezoelectric mode of AFM for characterizing piezoelectric & semi-conductor materials and electrostatic charge distributions. Supervised 3 master students during their final 6 months internship

PROFIL

Languages: French, English (TOEIC 790).

Research skills

- Deep analysis of complex results and information from different data sources, realistic and critical thinking, developed problem-solving ability. Report writing and synthesis. Technology and scientific intelligence.
- Abstraction for theoretical analysis, modeling and simulation problems. Resourceful, crafty, practical and efficient for designing and quick prototyping devices as well as experimenting while being autonomous.
- Teamwork, mentoring and small groups’ team leader. Communication and presentation toward scientific academics and professionals as well as popular audiences (Journées Scientifiques, Open doors).

Expertise

- Functional materials and electro-mechanical systems with emphasis on MEMS & NEMS technologies.
- Soft actuators and sensors for wearable robotic, soft exoskeleton and haptic applications.
- Mechanical energy harvesting for the development of autonomous and sustainable wearable systems.
- Full knowledge of R&D cycle from theory and simulation to prototyping and characterization.
 - Theoretical physics and modeling
 - Multiphysics and circuit simulations
 - Design and optimization
 - Quick prototyping and micro-fabrication
 - Electrical and mechanical characterization
 - Demonstration and user tests

Technical skills

Design 3D CAD, PCB design, lithography masks design

Simulate FEM (Comsol), electrical circuit modeling

Fabricate Clean Room, lithography, deposition (sputtering, evaporation, CVD), etching (wet, vapor, plasma), FDM 3D printing, laser cutting, blade casting

Measure SEM, AFM (KFM & PFM), mechanical – laser – optical profilometers
Shaker, pull tester, probe station, oscilloscope, parameter analyzer, lock-in amplifier
Electronic circuits (filters, PLL, 4 points), high voltage sources

Program VHDL, assembler, C, Python

Invited Peer-Reviewed Publications

1. Jessica Yin, **Ronan Hinchet**, Herbert Shea, Carmel Majidi, "Wearable Soft Technologies for Haptic Sensing and Feedback", in *Advanced Functional Materials*, (2020), 2007428. *Cited 25*
2. **Ronan Hinchet**, Usman Khan, Christian Falconi and Sang-Woo Kim, "Piezoelectric properties in two-dimensional materials: simulations and experiments", in *Materials Today*, vol. 21 (2018), 611. *Cited 115*
3. Usman Khan, **Ronan Hinchet**, Hanjun Ryu and Sang-Woo Kim, "Research Update: Nanogenerators for self-powered autonomous wireless sensors", in *APL Materials*, vol. 5 (2017), 73803. *Cited 27*
4. **Ronan Hinchet** and Sang-Woo Kim, "Wearable and Implantable Mechanical Energy Harvesters for Self-Powered Biomedical Systems", in *ACS Nano*, vol. 9 (2015), 7742. *Cited 98*
5. **Ronan Hinchet**, Wanchul Seung, and Sang-Woo Kim, "Recent Progress on Flexible Triboelectric Nanogenerators for Self-Powered Electronics", in *ChemSusChem*, vol. 8 (2015), 2327. *Cited 118*

Peer-Reviewed Publications

1. S.-D. Gravert, E. Varini, A. Kazemipour, M. Y. Michelis, T. Buchner, **R. Hinchet**, and R. K. Katzschnmann, "Low Voltage Electrohydraulic Actuators for Untethered Robotics," in *Adv. Sci.*, vol. 10 (2024).
2. **R. Hinchet**, and H. Shea, "Glove and sleeve-format variable-friction electrostatic clutches for kinesthetic haptics," in *Adv. Intell. Syst.*, vol. 4 (2022), 2200174.
3. E. Leroy, **R. Hinchet**, and H. Shea, "Multimode Hydraulically Amplified Electrostatic Actuators for Wearable Haptics," in *Adv. Mater.*, vol. 32 (2020), 2002564. *Cited 42*
4. **R. Hinchet** and H. Shea, "High Force Density Textile Electrostatic Clutch," in *Adv. Mater. Technol.*, vol. 5 (2020), 1900895. *Cited 20*
5. A. Marette, R. I. Haque, X. Ji, **R. Hinchet**, H. R. Shea and D. Briand, "Triboelectric-TFT Flip-Flop for Bistable Latching of Dielectric Elastomer Actuators," in *Adv. Electron. Mater.*, vol. 5 (2019), 1900205. *Cited 4*
6. **R. Hinchet**, H.-J. Yoon, H. Ryu, M.-K. Kim, E.-K. Choi, D.-S. Kim and S.-W. Kim, "Transcutaneous ultrasound energy harvesting using capacitive triboelectric technology," in *Science*, vol. 365 (2019), 491. *Cited 512*
7. A. Ghaffarinejad, J. Y. Hasani, **R. Hinchet**, Y. Lu, H. Zhang, A. Karami, D. Galayko, S.-W. Kim and P. Basset, "A conditioning circuit with exponential enhancement of output energy for triboelectric nanogenerator," in *Nano Energy*, vol. 51 (2018), 173. *Cited 46*
8. **Ronan Hinchet**, Ali Ghaffarinejad, Yingxian Lu, Javad Yavand Hasani, Sang-Woo Kim, Philippe Basset, "Understanding and modeling of triboelectric-electret nanogenerator," in *Nano Energy*, vol. 47 (2018), 401. *Cited 56*
9. A. Ghaffarinejad, Y. Lu, **R. Hinchet**, D. Galayko, J. Y. Hasani, S.-W. Kim and P. Basset, "Benet's doubler working as a power booster for triboelectric nano-generators," in *Electron. Lett.*, vol. 54 (2018), 378. *Cited 7*
10. H. Ryu, J. H. Lee, U. Khan, S. S. Kwak, **R. Hinchet**, and S.-W. Kim, "Sustainable direct current powering a triboelectric nanogenerator via a novel asymmetrical design," in *Energy Environ. Sci.*, vol. 11 (2018), 2057. *Cited 89*
11. S. S. Kwak, H. Kim, W. Seung, J. Kim, **R. Hinchet**, and S.-W. Kim, "Fully Stretchable Textile Triboelectric Nanogenerator with Knitted Fabric Structures," in *ACS Nano*, vol. 11 (2017), 10733. *Cited 126*
12. Seongsu Kim, Tae Yun Kim, Kang Hyuck Lee, Tae-Ho Kim, Francesco Arturo Cimini, Sung Kyun Kim, **Ronan Hinchet**, Sang-Woo Kim and Christian Falconi, "Rewritable ghost floating gates by tunnelling triboelectrification for two-dimensional electronics", in *Nature Communications*, vol. 8 (2017), 15891. *Cited 48*
13. Jeong Hwan Lee*, **Ronan Hinchet*** (co-authors), Sung Kyun Kim, Sanghyun Kim and Sang-Woo Kim, "Shape memory polymer-based self-healing triboelectric nanogenerator", in *Energy Environ. Sci.*, vol. 8 (2015), 3605. *Cited 152*
14. Ju-Hyuck Lee*, **Ronan Hinchet*** (co-authors), Tae Yun Kim, Hanjun Ryu, Wanchul Seung, Hong-Joon Yoon, Sang-Woo Kim, "Control of Skin Potential by Triboelectrification with Ferroelectric Polymers", in *Advanced Materials*, vol. 27 (2015), 5553. *Cited 72*
15. S. Lee, **R. Hinchet**, Y. Lee, Y. Yang, Z.-H. Lin, G. Ardila, L. Montes, M. Mouis, Z. L. Wang, "Ultrathin Nanogenerators as Self-powered/Active Skin Sensors for Tracking Eye Ball Motion", in *Advanced Functional Materials*, vol. 24 (2014), 1163. *Cited 126*
16. **Hinchet R.**, Lee S., Ardila G., Montes L., Mouis M., Wang Z. L., "Performance Optimization of Vertical Nanowire-Based Piezoelectric Nanogenerators", in *Advanced Functional Materials*, vol. 24 (2014), 971. *Cited 114*
17. **R. Hinchet**, S. Lee, G. Ardila, L. Montes, M. Mouis and Z.-L. Wang, "Design and Guideline Rules for the Performance Improvement of Vertically Integrated Nanogenerator", in *Journal of Energy and Power Engineering*, vol. 7 (2013), 1816.
18. Ardila G., **Hinchet R.**, Mouis M., Montes L., "Scaling prospects in mechanical energy harvesting with piezo nanowires", in *The European Physical Journal Applied Physics*, vol. 63 (2013) 14407.
19. Y.S. Zhou*, **R. Hinchet*** (co-authors), Y. Yang, G. Ardila, R. Songmuang, F. Zhang, Y. Zhang, W. Han, K. Pradel, L. Montes, M. Mouis and Z.L. Wang, "Nano-newton transverse force sensor using a vertical GaN nanowire based on the piezotronic effect", in *Advanced Materials*, vol. 25 (2013), 883. *Cited 79*

Published peer-reviewed proceedings

1. J. Obrist, M. Zamora, H. Zheng, **R. Hinchet**, F. Ozdemir, J. Zarate, R. K. Katzschnmann, S. Coros. "PokeFlex: A Real-World Dataset of Deformable Objects for Robotics," in *ICLR 2025*, (2025) - *submitted*

2. A. Kazemipour, **R. Hinchet**, R. K. Katzschmann. "Stretchable Electrohydraulic Artificial Muscle for Full Motion Ranges in Musculoskeletal Antagonistic Joints," in ICRA 2025, (2025) - *submitted*.
3. J. Montes, Y. Du, **R. Hinchet**, S. Coros, B. Thomaszewski. "FlexScale: Modeling and Characterization of Flexible Scaled Sheets," in ACM SIGGRAPH Asia '24, (2024).
4. P. Tang, **R. Hinchet**, R. Poranne, B. Thomaszewski, and S. Coros. "Modal Folding: Discovering Smooth Folding Patterns for Sheet Materials using Strain-Space Modes," in ACM SIGGRAPH Asia '24, (2024).
5. J. Montes, **R. Hinchet**, S. Coros, and B. Thomaszewski. "ToRoS: A Topology Optimization Approach for Designing Robotic Skins," in ACM SIGGRAPH Asia '23, (2023). *Cited 4*
6. J. Montes, Y. Du, **R. Hinchet**, S. Coros, and B. Thomaszewski. "Differentiable Stripe Patterns for Inverse Design of Structured Surfaces," in ACM SIGGRAPH '23, (2023) - **Best Technical paper award**
7. V. Vechev, **R. Hinchet**, S. Coros, B. Thomaszewski, and O. Hilliges. "Computational Design of Active Kinesthetic Garments," in The 35th Annual ACM Symposium on User Interface Software and Technology- UIST, (2022), 23.
8. V. Vechev, J. Zarate, D. Lindlbauer, **R. Hinchet**, H. Shea, and O. Hilliges, "TacTiles: Dual-Mode Low-Power Electromagnetic Actuators for Rendering Continuous Contact and Spatial Haptic Patterns in VR," in 2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR), (2019), 312. *Cited 10*
9. **R. Hinchet**, V. Vechev, H. Shea, and O. Hilliges, "DextrES: Wearable Haptic Feedback for Grasping in VR via a Thin Form-Factor Electrostatic Brake," in The 31st Annual ACM Symposium - UIST '18, (2018), 901. *Cited 44*
10. A. Ghaffarnejad, Y. Lu, **R. Hinchet**, D. Galayko, J. Y. Hasani, and P. Basset, "Bennet's charge doubler boosting triboelectric kinetic energy harvesters," in PowerMEMS 2017, vol. 54 (2018), 378. *Cited 4*
11. R. Tao, **R. Hinchet**, G. Ardila, L. Montès and M. Mouis, "FEM modeling of vertically integrated nanogenerators in compression and flexion modes", in 2014 10th Conference on Ph.D. Research in Microelectronics and Electronics (PRIME), (2014), 4.
12. Ran. Tao, **Ronan. Hinchet**, Gustavo. Ardila and Mireille. Mouis, "Evaluation of Vertical Integrated Nanogenerator Performances in Flexion", in Journal of Physics: Conference Series (PowerMEMS), vol. 476 (2013), 12006. *Cited 12*
13. **R. Hinchet**, J. Ferreira, J. Keraudy, G. Ardila, E. Pauliac-Vaujour, M. Mouis and L. Montes, "Scaling rules of piezoelectric nanowires in view of sensor and energy harvester integration", in 2012 International Electron Devices Meeting IEDM, (2012), 6.2.1. *Cited 9*
14. G. Ardila, **R. Hinchet**, M. Mouis, L. Montes, "Scaling Prospects in Mechanical Energy Harvesting using Piezoelectric Nanostructures", in 2012 International Semiconductor Conference Dresden-Grenoble (ISCDG), (2012), 75.
15. **R. Hinchet**, S. Lee, G. Ardila, L. Montes, M. Mouis and Z.L. Wang, "Design and guideline rules for the performance improvement of vertically integrated nanogenerator", in Proceedings 2012 PowerMEMS, (2012), 38.
16. **R. Hinchet**, L. Montes, G. Bouteloup, G. Ardila, R. Parsa, K. Akarvardar, R.T. Howe and H.-S. Philip Wong, "Electrical and mechanical characterization of lateral NEMS switches", in 2011 Symposium on Design, Test, Integration and Packaging of MEMS/MOEMS (DTIP), (2011), 348.

Published Book Chapters

1. Tao R., Ardila G., **Hinchet R.**, Michard A., Montès L. and Mouis M., "Will Composite Nanomaterials Replace Piezoelectric Thin Films for Energy Transduction Applications?", in *Future Trends in Microelectronics*, John Wiley & Sons Inc., (2016), 291.
2. G. Ardila, A. Kaminski, M. Pala, A. Cresti, L. Montes, V. Consonni, **R. Hinchet**, J. Michallon, M. Daanoune, M. Zanucoli, C. Fiegna, M. Mouis, "Towards Self-Powered Systems: Using Nanostructures to Harvest Ambient Energy", in *Functional Nanomaterials and Devices for Electronics, Sensors and Energy Harvesting*, Springer International Publishing, (2014), 223.
3. L. Larcher, S. Roy, D. Mallick, P. Podder, M. de Vittorio, T. Todaro, F. Guido, A. Bertacchini, **R. Hinchet**, J. Keraudy and G. Ardila, "Vibrational energy harvesting", in *Beyond-CMOS Nanodevices 1*, John Wiley & Sons Inc, (2014), 89. *Cited 4*
4. G. Ardila, **R. Hinchet**, L. Montes, M. Mouis, "Piezoelectric Nanostructures for Mechanical Energy Harvesting", in *Physics, Chemistry and Applications of Nanostructures*, World Scientific, (2013), 463.
5. Ardila G., **Hinchet R.**, Montes L. and Mouis M., "Mechanical Energy Harvesting with Piezoelectric Nanostructures: Great Expectations for Autonomous Systems", in *Future Trends in Microelectronics*, John Wiley & Sons Inc., (2013), 230.

Invited talks and keynote conferences Talks

1. **Ronan Hinchet**, "High Force Density Flexible Electrostatic Clutch", at *Active Materials & Soft Mechatronics 2019 (AMSM)*, October 16-19 2019, Incheon KR. **Received the AMSM 2019 "Young Scientist Award"**
2. **R. Hinchet**, "Better understand triboelectric generator challenges in view of self-powered electronics", at *Materials Challenges in Alternative & Renewable Energy 2017 (MCARE)*, February 20-24 2017, Jeju KR.
3. **Ronan Hinchet**, "Triboelectric Nanogenerators for Self-Powered Electronics", at *9th Pacific Rim International Congress on Advanced Materials and Processing (PRICM-9)*, Aug 1-5 2016, Kyoto JP.
4. **R. Hinchet**, "Piezoelectric effects in nanomaterials for energy harvesting applications", at *1st International symposium on Emerging Functional Materials (IEFM)*, November 4-6 2015, Incheon KR.
5. **R. Hinchet**, "Nanogenerators for Self- Powering Electronics", at *Polymer Processing Society 2015 (PPS)*, June 7-11 2015, Jeju KR.

6. **R. Hinchet**, “Structure and material improvement for Piezoelectric and Triboelectric Nanogenerators”, at *Materials Challenge in Alternative & Renewable Energy 2015 (MCARE)*, February 24-27 2015, Jeju KR, (**Chairman session 5-5**)

Filed patents

1. **Ronan Hinchet** and Herbert Shea, “Electrostatic brake-based haptic device”, U.S. Patent Application n° 17/258,511, filed on September 2, 2021.
2. **Ronan Hinchet** and Herbert Shea, “Electrostatic brake-based haptic device”, *International Patent application n° PCT/IB2018/055075*, filed on July 10, 2018.
3. S-W. Kim, **R. Hinchet**, S. S. Kim, C. Seung, J. Yoon, J-H. Lee, U. Khan, “Electric energy harvesting using ultrasonic wave”, *U.S. Patent Application number 15/200,591*, filed on July 1, 2016.
4. S-W. Kim, H. Kim, T. Y. Kim, **R. Hinchet**, S. Kwak, “Stretchable hybrid generator”, *Korean Patent Application number 10-2015-0175582*, filed on Dec 10, 2015.
5. S-W. Kim, **R. Hinchet**, S. Kim, W. C. Seung, H. J. Yoon, J. H. Lee, C. Falconi, U. Khan, “Electric energy harvesting using ultrasonic wave”, *Korean Patent Application number 10-2015-0095180*, filed on July 3, 2015.

Reviewed for *Science Robotics, Sensors and Actuators A, Smart Materials and Structures and Nano energy. Robotics and Automation Letters, Energy & Environmental Science, ACS Nano, ACS advances, Nano Letters, Advanced Energy Materials, Nature Communications, Scientific Reports.*

FELLOWSHIP and PRIZES

- 2019** “Young Scientist Award” **Prize** by the Chairs of the 4th Active Materials and Soft Mechatronics (AMSM) international conferences at Incheon (KR)
- 2015** “Basic research project in science and engineering field” **Research fellowship** from the Korean ministry of science, ICT and future planning for 3 years of R&D on Mechanical energy harvesting devices as researcher in Sungkyunkwan University (KR).
- 2015** Selected 2/123 of the Ph.D. thesis defended in 2014 at the **Grenoble EEATS Ph.D. School UGA PhD Prize**. Selected in top 20/1200 of the PhD Thesis defended in 2014 from the University Grenoble Alpes including all disciplines (FR).
- 2012** “Explo’ra Doc” **PhD scholarship** from the Rhône-Alpes region for 6 months of international mobility as exchange student in Georgia Tech (US).
- 2009** “Explo’ra Sup” **Master scholarship** from the Rhône-Alpes region for 1 year of international mobility as exchange student in Polytech Montreal (CA).