

Hyunwoo Yuk

77 Massachusetts Ave. Room 1-025
Cambridge, MA, 02139, United States
Phone: +1 (857) 209 - 1500

E-mail: hyunwoo@mit.edu / Webpage: hyunwooyuk.com

RESEARCH INTERESTS

- Hydrogel-based human-machine interface
- Mechanics of soft materials
- 3D printing of soft materials
- Bioelectronics
- Soft active materials and robots

DEGREE & EDUCATION

Ph.D. IN MECHANICAL ENGINEERING

Jun 2016 - Present

Massachusetts Institute of Technology, Cambridge, MA, United States
MIT Soft Active Materials Laboratory (Advisor: Prof. Xuanhe Zhao)

M.S. IN MECHANICAL ENGINEERING

Sep 2014 - Jun 2016

Massachusetts Institute of Technology, Cambridge, MA, United States
MIT Soft Active Materials Laboratory (Advisor: Prof. Xuanhe Zhao)
(Thesis: Tough wet adhesion of hydrogel on various materials - mechanism and application)

B.S. IN MECHANICAL ENGINEERING

Feb 2007 - Feb 2014

Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Republic of Korea
Graduation with *Summa Cum Laude*
(Note: Military Service during June 2011 - June 2013)

AWARDS & HONORS

- Peebles Award, The Adhesion Society, 2019
- Member of *Sigma Xi*, The Scientific Research Honor Society
- Forbes 30 Under 30 2019: Science, Forbes, 2018
- Face of the Year, Samsung Scholarship, Summer 2018
- MRS Graduate Student Award, Materials Research Society, Spring 2018
- 2015 Samsung Scholarship, Samsung Scholarship Foundation, Fall 2015
- *Summa Cum Laude*, KAIST, Spring 2014
- 2013 Samsung Scholarship, Samsung Scholarship Foundation, Fall 2013

- Outstanding Achievement *Cum Laude* Award, Department of Mechanical Engineering, KAIST, Fall 2010
- Outstanding Achievement *Cum Laude* Award, Department of Mechanical Engineering, KAIST, Fall 2009
- Korean Governmental Scholarship, KAIST, 2007-2010

RESEARCH EXPERIENCE

GRADUATE RESEARCH ASSISTANT

Sep 2014 - Present

MIT Soft Active Materials Laboratory (PI: Prof. Xuanhe Zhao)

- Hydrogel-based human-machine interface
- Mechanics of soft materials
- 3D printing of soft materials
- Bioelectronics
- Soft active materials and robots

UNDERGRADUATE RESEARCHER

Jun 2009 - Apr 2011

Intelligent Systems & Neurobotics Laboratory (PI: Prof. Sungho Jo), KAIST, Daejeon, Republic of Korea

Soft Biomechanics & Biomaterials Laboratory (PI: Prof. Jennifer H. Shin), KAIST, Daejeon, Republic of Korea

- Design and control of small crawling robot inspired by the motion and the biological structure of the nematode *Caenorhabditis elegans* (*C.elegans*)
- Development of small linear actuators mimicking biological muscle using thermal shape memory alloy (SMA)
- Development of simple CPG patterned motion control mechanism inspired by the muscular activations of *C.elegans* during locomotion

UNDERGRADUATE RESEARCH PROGRAM (URP)

Dec 2009 - May 2010

Mechatronics, Systems and Control Laboratory (PI: Prof. Kyungsoo Kim), KAIST, Daejeon, Republic of Korea

- Dynamic analysis and computational simulation on rotating mass control (RMC) for floating body stabilization aimed at mobile harbor applications

OTHER EXPERIENCE

TEACHING CERTIFICATE PROGRAM

May 2017 - Jun 2017

MIT Kaufman Teaching Certificate Program

- Institute supported certificate program for development of teaching skills

PUBLIC SERVICE PERSONNEL

Jun 2011 - Jun 2013

Sungsan Elementary School, Daegu, Republic of Korea

- Daytime assistance and caring for disabled pupils in the elementary school

(Note: Public Service Personnel is a form of military service duty in Republic of Korea)

INVITED TALKS & SEMINARS

1. Soft materials platform for living materials and devices, DGIST, Jul 2017
2. Tough wet adhesion of hydrogels, IRG meeting, MIT, Dec 2015
3. Multi-scale multi-mechanism design of tough and bioactive hydrogels: Theory, experiment and application, Invited graduate student seminar, University of Connecticut, Apr 2015

PUBLICATIONS

JOURNAL PUBLICATIONS

Notes: # indicates equally contributing first authors. * indicates the corresponding author(s).

First Authored Papers

1. A. Inoue#, **H. Yuk#**, B. Lu, X. Zhao*, TBD, submitted (2019)
2. **H. Yuk**, C. E. Varela, C. S. Nabzdyk, E. Roche, X. Zhao*, TBD, submitted (2019)
3. B. Lu#, **H. Yuk#**, K. Qu, N. Jian, S. Lin, J. Xu, X. Zhao*, Pure PEDOT:PSS hydrogels, *Nature Communications*, in press (2019)
4. S. Park#, **H. Yuk#**, R. Zhao, Y. S. Yim, E. W. Woldegebriel, J. Kang, Y. Fink, G. B. Choi, X. Zhao*, P. Anikeeva*, TBD, submitted (2018)
5. Y. Yu#, **H. Yuk#**, G. A. Parada#, Y. Yu, X. Liu, C. S. Nabzdyk, K. Youcef-Toumi, J. Zang, X. Zhao*, Multifunctional hydrogel skins on diverse polymers with arbitrary shapes, *Advanced Materials* doi: 10.1002/adma.201807101 (2018) (selected as cover)
6. **H. Yuk**, B. Lu, X. Zhao*, Hydrogel bioelectronics, *Chemical Society Review*, doi: 10.1039/C8CS00595H (2018) (review article)
7. Y. Km#, **H. Yuk#**, R. Zhao#, S. Chester, X. Zhao*, Printing ferromagnetic domains for untethered fast-transforming soft materials, *Nature* **558**, 274-279 (2018) (selected as cover)
8. X. Liu#, **H. Yuk#**, S. Lin, G. A. Parada, T.-C. Tang, E. Tham, C. Fuente, T. K. Lu, X. Zhao*, 3D printing of living responsive materials and devices, *Advanced Materials* **30**, 1704821 (2018) (selected as cover)
9. **H. Yuk**, X. Zhao*, A new 3D printing strategy by harnessing deformation, instability, and fracture of viscoelastic inks, *Advanced Materials* **30**, 1704028 (2018) (selected as cover)
10. T. Zhang#, **H. Yuk#**, S. Lin, G. A. Parada, X. Zhao*, Tough and tunable adhesion of hydrogels: experiments and models, *Acta Mechanica Sinica* **33**, 543-554 (2017)

11. X. Liu#, T.-C. Tang#, E. Tham#, **H. Yuk**#, S. Lin, T. K. Lu*, X. Zhao*, Stretchable living materials and devices with hydrogel-elastomer hybrids hosting programmed cells, *Proceedings of National Academy of Science* **114**, 2200-2205 (2017)
12. **H. Yuk**, S. Lin, C. Ma, M. Takaffoli, N. Fang, X. Zhao*, Hydraulic hydrogel actuators and robots optically and sonically camouflaged in water, *Nature Communications* **8**, 14230 (2017)
13. **H. Yuk**, T. Zhang, G. A. Parada, X. Liu, X. Zhao*, Skin-inspired hydrogel-elastomer hybrids with robust interfaces and functional microstructures, *Nature Communications* **7**, 12028 (2016)
14. S. Lin#, **H. Yuk**#, T. Zhang#, H. Koo, C. Yu, X. Zhao*, Stretchable hydrogel electronics and devices, *Advanced Materials* **28**, 4497-4505 (2016)
15. **H. Yuk**, T. Zhang, S. Lin, G. Parada, X. Zhao*, Tough bonding of hydrogels to diverse non-porous surfaces, *Nature Materials* **15**, 190-196 (2016)
16. **H. Yuk**, D. Kim, H. Lee, S. Jo*, J. H. Shin*, Shape memory alloy-based small crawling robots inspired by *C.elegans*, *Bioinspiration and Biomimetics* **6**, 046002 (2011)

Contributing Authored Papers

17. X. Liu#, C. Steiger#, S. Lin#, G. A. Parada, J. Liu, H. F. Chan, **H. Yuk**, N. V. Phan, J. Collins, S. Tamang, G. Traverso, X. Zhao*, Ingestible hydrogel device, *Nature Communications* **10**, 493 (2019)
18. S. Lin#, X. Liu#, J. Liu#, **H. Yuk**, H.-C. Loh, G. A. Parada, C. Settens, J. Song, A. Masic, G. H. McKinley, X. Zhao*, Anti-fatigue-fracture hydrogels, *Science Advances* **5**, eaau8528 (2019)
19. R. Zhao, S. Lin, **H. Yuk**, X. Zhao*, Kirigami enhancing film adhesion: mechanism and applications to Kirigami wearables, *Soft Matter* **14**, 2515-2525 (2018)
20. S. Lin, Y. Mao, **H. Yuk**, X. Zhao*, Material-stiffening suppresses elastic fingering and fringe instabilities, *International Journal of Solids and Structures* **139**, 96-104 (2018)
21. G. A. Parada, **H. Yuk**, X. Liu, A. Hsieh, X. Zhao*, Impermeable robust hydrogels via hybrid lamination, *Advanced Healthcare Materials* **6**, 1700520 (2017)
22. S. Lin#, T. Cohen#, T. Zhang#, **H. Yuk**, R. Abeyaratne, X. Zhao*, Fringe instability in constrained soft elastic layers, *Soft Matter* **12**, 8899-8906 (2016)
23. J. Guo, X. Liu, N. Jiang, A. K. Yetisen, **H. Yuk**, C. Yang, A. Khademhosseini, X. Zhao, S-H. Yun*, Highly stretchable, strain sensing hydrogel optical fibers, *Advanced Materials* **28**, 10244-10249 (2016)
24. T. Zhang#, S. Lin#, **H. Yuk**, X. Zhao*, Predicting fracture energies and crack-tip fields of soft tough materials, *Extreme Mechanics Letters* **4**, 1 (2015)

CONFERENCE PROCEEDINGS & PRESENTATIONS

1. **H. Yuk**, X. Zhao, Robust hydrogel-solid hybrids for biomedical applications, 2018 MRS Fall, Boston, USA, Nov 2018
2. **H. Yuk**, X. Zhao, 3D printing of soft active materials, 2018 IMECE, Pittsburgh, USA, Nov 2018

3. **H. Yuk**, X. Zhao, 3D printing of programmable soft active materials, 2018 USNC/TAM, Chicago, USA, Jun 2018
4. **H. Yuk**, X. Zhao, Toward Next Generation Hydrogel Machines: Tough Bonding to 3D Printing, 2018 MRS Spring, Phoenix, USA, Apr 2018
5. **H. Yuk**, X. Zhao, 3D printing by harnessing deformation, instability, and fracture of viscoelastic inks, 2017 MRS Fall, Boston, USA, Dec 2017
6. **H. Yuk**, X. Zhao, 3D printing by harnessing deformation, instability, and fracture of viscoelastic inks, 2017 IMECE, Tampa, USA, Nov 2017
7. **H. Yuk**, X. Zhao, Hydrogel actuators and robots: high-speed, high-force, and camouflage, 2017 IMECE, Tampa, USA, Nov 2017
8. **H. Yuk**, X. Zhao, Phase-diagram assisted 3D printing of viscoelastic materials, 2017 SES, Boston, USA, Jul 2017
9. **H. Yuk**, S. Lin, C. Ma, M. Takaffoli, N. Fang, X. Zhao, Hydraulic hydrogel actuators and robots optically and sonically camouflaged in water, 2016 MRS Fall, Boston, USA, Nov 2016 (poster presentation)
10. **H. Yuk**, T. Zhang, S. Lin, X. Zhao, Skin-inspired robust hydrogel-elastomer hybrids, 2016 MRS Fall, Boston, USA, Nov 2016
11. **H. Yuk**, T. Zhang, S. Lin, G. A. Parada, X. Zhao, Tough wet adhesion of hydrogels, 2015 MRS Fall, Boston, USA, Dec 2015
12. **H. Yuk**, T. Zhang, S. Lin, G. A. Parada, X. Zhao, Tough wet adhesion of hydrogels to diverse non-porous surfaces, 2015 IMECE, Houston, USA, Nov 2015 (poster presentation)
13. **H. Yuk**, T. Zhang, S. Lin, G. A. Parada, X. Zhao, Tough wet adhesion of hydrogels, 2015 SES, Texas A&M University, USA, Nov 2015
14. **H. Yuk**, S. Jo, J. H. Shin, Biomimetic crawling robot, International Symposium on Nature-Inspired Technology (ISNIT), Seoul, South Korea, Oct 2010 (poster presentation)
15. **H. Yuk**, J. H. Shin, S. Jo, Crawling robot design mimicking *C.elegans*, Proceedings of 7th International Conference on Ubiquitous Robots & Ambient Intelligence (URAI), Busan, South Korea, Nov 2010
16. **H. Yuk**, J. H. Shin, S. Jo, Design and control of thermal SMA based small crawling robot mimicking *C.elegans*, Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Taipei, Taiwan, Oct 2010 (**proceeding published, doi: 10.1109/IROS.2010.5651043**)
17. **H. Yuk**, J. H. Shin, S. Jo, Design and control of thermal SMA based small crawling robot mimicking *C.elegans*, Spring Meeting 2010, Korean Society of Mechanical Engineers, Jeju Island, South Korea, May 2010 (poster presentation)

PATENTS

1. **H. Yuk**, X. Zhao, Hydrogel-elastomer hybrids, WO 2017164902 (2017)
2. **H. Yuk**, S. Lin, T. Zhang, X. Zhao, Stretchable, robust and biocompatible hydrogel electronics and devices, WO2017069910 (2017)

3. **H. Yuk**, S. Lin, T. Zhang, G. Parada, X. Zhao, Multifunctional bonding of hydrogels, WO 2017027088 (2017)
4. **H. Yuk**, S. Lin, X. Zhao, Extremely compliant yet tough hydrogel system as ultrasound transmission agents, WO 2016106171 (2016)

MEDIA COVERAGES (SELECTED LIST)

1. I am selected as [Forbes 30 Under 30 2019: Science](#)
2. The paper “Printing ferromagnetic domains for untethered fast-transforming soft materials (published in *Nature*)” was covered in [MIT News](#), [Forbes](#), [BBC](#), [National Geographic](#)
3. The paper “A new 3D printing strategy by harnessing deformation, instability, and fracture of viscoelastic inks (published in *Advanced Materials*)” was covered in [Advanced Science News](#)
4. The paper “3D printing of living responsive materials and devices (published in *Advanced Materials*)” was covered in [MIT News](#), [Advanced Science News](#)
5. The paper “Impermeable robust hydrogels via hybrid lamination (published in *Advanced Healthcare Materials*)” was covered in [MIT News](#)
6. The paper “Stretchable living materials and devices with hydrogel-elastomer hybrids hosting programmed cells (published in *PNAS*)” was covered in [MIT News](#), [Gizmodo](#)
7. The paper “Hydraulic hydrogel actuators and robots optically and sonically camouflaged in water (published in *Nature Communications*)” was covered in [MIT News](#), [Gizmodo](#), [The Verge](#), [Fox News](#), [Popular Science](#)
8. The paper “Highly stretchable, strain sensing hydrogel optical fibers (published in *Advanced Materials*)” was covered in [MIT News](#), [Fox News](#)
9. The paper “Skin-inspired hydrogel-elastomer hybrids with robust interfaces and functional microstructures (published in *Nature Communications*)” was covered in [MIT News](#), [Boston Magazine](#), [Bloomberg](#)
10. The paper “Stretchable hydrogel electronics and devices (published in *Advanced Materials*)” was covered in [MIT News](#), [NBC News](#), [Boston Herald](#), [MIT Technology Review](#), [Smithsonian Magazine](#)
11. The paper “Tough bonding of hydrogels to diverse non-porous surfaces (published in *Nature Materials*)” was covered in [MIT News](#), [Forbes](#), [Vice](#), [Materials Today](#)