Tianda Fu

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Education:

2017	B.S.	Precision Instrument, Chongqing University (CQU), Chongqing, China
2023	Ph.D.	Electrical & Computer Engineering, University of Massachusetts (UMass) Amherst, MA, USA

Professional Appointments:

2024.1-present	Postdoc researcher, Pritzker School of Molecular Engineering, UChicago, IL, USA

Research Interest:

- Neuromorphic Devices & Neuromorphic Computing
- Stretchable & Wearable Electronics
- Organic Electrochemistry Transistor (OECT)

Research Experience:

A. Ph.D. Phase (2018-2023)

Thesis Topic: Bio-voltage Memristor: Performance, Mechanism, and Implementation
Advisor: Jun Yao
Description: We invented a bio-voltage memristor, whose operation voltage is as low as the biological amplitude (e.g., 50-120 mV). The device was made of protein nanowires harvested from microbe *G. Sulfurreducens*, which is considered the key factor for bio-voltage switching, possibly attributed to the protein nanowires catalyze metallization. With the advantage of low-voltage switching, we developed the parameter-matched artificial synapse & neurons for wearable electronics. In addition, we also proposed a new strategy to address the sneak-path issue by utilizing memristor relaxation. Such a strategy was also extended to other electrical components (e.g., diode) for high-efficient neuromorphic computing.

B. Undergraduate Phase (2015-2017)

Thesis Topic: 3D Positioning Technology based on SEMG and MIMU
Advisor: Chunhua Ren
Description: We proposed a 3D pedestrian position system combined with commercial microelectromechanical systems micro-inertial measurement unit (MIMU) and surface electromyography (SEMG) sensor. The sensory signals were used to recognize the pedestrian's motion patterns and speed via the L-M machine learning algorithm as compensation information to MIMU. Finally, satisfied 3-D position accuracy is obtained in two terrain environments, demonstrating the proposed strategy's feasibility.

Research Skills:

A. Instrumentation Design

- Circuit Design & Simulation (e.g., Altium Designer, LT Spice)
- PCB Development (e.g., Amplifier, MCU, Filter)
- Software Development (e.g., C, C#, MATLAB)
- 2D/3D Modeling (Auto CAD, SOLIDWORKS, 3D MAX)

B. Nanofabrication

- Photolithography, E-beam Lithography, Laser Lithography
- Material Growth (e.g., ALD, Sputtering, Evaporator)
- Etching (e.g., Wet Etching, RIE, DRIE)
- Flexible Substrate Development (e.g., PI film, PDMS)

C. Neuromorphic Computing

- Volatile Memristor Design and Fabrication (e.g., Protein Nanowires-based)
- Nonvolatile Memristor Design and Fabrication (e.g., Ta-HfO_2-based, Ta-Ta_2O_5-based)

- Computing Peripheral Circuit Development (e.g., MCU, DAC, ADC, Amplifier, MUX)
- Machine Learning Algorithm Implementation (e.g., Back Propagation Algorithm)

D. Wearable electronics

- Stretchable sensor & electronics development (e.g., resistor, capacitor, inductor, diode, transistor)
- Wearable circuits design and integration
- Wireless communication technology (e.g., Bluetooth, Wi-Fi, RF coupling)

Publications:

A. First author, and Corresponding author (*) publications:

[A7] Tianda Fu, Lu Sun, Shuai Fu, Robert Stevens, Trevor Woodard, Derek R. Lovley, Jun Yao, "**Bio-inspired xxx**" Finalization.

[A6] Tianda Fu$^{\Psi}$, Shuai Fu$^{\Psi}$, Siqi Wang, Jun Yao, "**One-Diode-One-Memristor in-situ learning using diode reverse recovery time**" ($^{\Psi}$: equal contribution) Device, 2, 100329 (2024).

[A5] Tianda Fu, Shuai Fu, Jun Yao, "**Recent Progress in Memristors Working with Ultralow Voltage of Biological Amplitude**" Nanoscale, 15, 4669-4681 (2023). (*Review*)

[A4] Tianda Fu, Shuai Fu, Lu Sun, Hongyan Gao, Jun Yao, "**An Effective Sneak-Path Solution Based on Transient-Relaxation Device**" Advanced Materials, 35, 2207133 (2023).

[A3] Tianda Fu, Xiaomeng Liu, Shuai Fu, Trevor Woodard, Hongyan Gao, Derek R. Lovley, Jun Yao, "**Self-Sustained Neuromorphic Interfaces.**" Nature Communications 12, 3351 (2021).

[A2] Tianda Fu, Xiaomeng Liu, Hongyan Gao, Joy E. Ward, Xiaorong Liu, Bing Yin, Zhongrui Wang, Ye Zhuo, David J. F. Walker, J. Joshua Yang, Jianhan Chen, Derek R. Lovley, Jun Yao. "**Bioinspired bio-voltage memristors.**" Nature Communications 11, 1861 (2020).

[A1] Chunhua Ren, Tianda Fu*, Meilin Zhou, and Xiaoming Hu. "**Low-Cost 3-D Positioning System Based on SEMG and MIMU.**" IEEE Transactions on Instrumentation and Measurement 67, 876-884 (2018).

B. Other cooperative publications:

[B9] Shuai Fu, Ji-Hoon Park, Hongyan Gao, Tianyi Zhang, Xiang Ji, Tianda Fu, Lu Sun, Jing Kong, Jun Yao, "**Two-Terminal MoS2 Memristor and the Homogeneous Integration with a MoS2 Transistor for Neural Networks**", Nano. Lett. 23, 5869-5876 (2023).

[B8] Hongyan Gao, Feiyu Yang, Kianoosh Sattari, Xian Du, Tianda Fu, Shuai Fu, Xiaomeng Liu, Jian Lin, Yubing Sun, Jun Yao, "**Bioinspired *Two-in-One* Nanotransistor Sensor for the Simultaneous Measurements of Electrical and Mechanical Cellular Responses**", Science Advances 8, eabn2485 (2022).

[B7] Xiaomeng Liu, Toshiyuki Ueki, Hongyan Gao, Trevor L. Woodard, Kelly P. Nevin, Tianda Fu, Shuai Fu, Lu Sun, Derek R. Lovley, Jun Yao, "**Microbial Biofilms for Electricity Generation from Water Evaporation and Power to Wearables",** Nature Communications 13, 4369 (2022).

[B6] Xiaomeng Liu, Tianda Fu, Joy Ward, Hongyan Gao, Bing Yin, Trevor Woodard, Derek R. Lovley, Jun Yao, "**Multifunctional Protein-Nanowire Humidity Sensors for Green Wearable Electronics**," Advanced Electronic Materials 6, 2000721 (2020).

[B5] Alexander F Smith, Xiaomeng Liu, Trevor L Woodard, Tianda Fu, Todd Emrick, Juan M Jiménez, Derek R Lovley, Jun Yao. "**Bioelectronic protein nanowire sensors for ammonia detection.** " Nano Research 13, 1479-1484 (2020).

[B4] Xiaomeng Liu, Hongyan Gao, Joy E. Ward, Xiaorong Liu, Bing Yin, Tianda Fu, Jianhan Chen, Derek R. Lovley, and Jun Yao. "**Power generation from ambient humidity using protein nanowires.**" Nature 578, 550–554 (2020).

[B3] Hongyan Gao, Bing Yin, Siyu Wu, Xiaomeng Liu, Tianda Fu, Cheng Zhang, Jian Lin, and Jun Yao. "**Deterministic Assembly of Three-Dimensional Suspended Nanowire Structures.**" Nano letters 19, 5647-5652 (2019).

[B2] Bing Yin, Xiaomeng Liu, Hongyan Gao, Tianda Fu, and Jun Yao. "**Bioinspired and bristled microparticles for ultrasensitive pressure and strain sensors.**" Nature communications 9, 5161 (2018).

[B1] Chunhua Ren, Qinqin Liu, and Tianda Fu. "**A novel self-calibration method for MIMU.**" IEEE Sensors Journal 15, 5416-5422 (2015).

Patents:

[1] Jun Yao, Derek R. Lovley, Tianda Fu, "**Memristor device comprising protein nanowires**", US Patent, 17/226, 016. (Files 2021-10-28)

[2] Tianda Fu, "**burglar-proof padlock**", China Patent, CN105064811B, 2017-06-27.

[3] Tianda Fu, "**automatic pay-off machine**", China Patent, CN204751714U, 2015-11-11.

[4] Tianda Fu, Fan Zhang, "**portable windshield wiper**", China Patent, CN204309746U, 2015-05-06.

Teaching Experience:

Fall 2021	Teaching Assistant	*Circuits and Electronics I*	UMass Amherst
Fall 2020	Teaching Assistant	*Circuits and Electronics I*	UMass Amherst
Spring 2020	Teaching Assistant	*Introduction to Digital and Computer Systems*	UMass Amherst
Fall 2019	Teaching Assistant	*Circuits and Electronics II*	UMass Amherst

Fellowship, Awards, and Grants:

- Chinese Government Award for Outstanding Students Abroad, worldwide (2023)
- Harvey Fellowship, worldwide (2022, 2023)
- 1st Place in 3-Minute-Thesis (3MT) Competition, UMass Amherst (2021)
- Predissertation Research Grants, UMass Amherst (2021)
- Outstanding Undergraduate Thesis, CQU (2017)
- Outstanding Undergraduate, CQU (2017)
- 1st Place in the National Environmental-friendly Science & Technology Competition, national wide (2016)
- 2nd/3rd Class Fellowship, CQU (2016, 2017)
- HAIYUNTIAN Big Data Fellowship, CQU (2016)

Service:

A. Journal Reviewer

Active reviewer for more than fifteen journals, such as:

- Advanced Science
- Advanced Electronic Materials
- Frontiers in Neuroscience (*Editorial Board*)
- Neural Computing and Application
- IEEE Electron Device Letter
- IEEE Transaction on Systems, Man, and Cybernetics: System

B. Fellowship Evaluator

- 2023 Harvey Fellowship Evaluation