ROBERT A. NAWROCKI

Robert.Nawrocki@ntech.t.u-tokyo.ac.jp postmaster@rnawrocki.com
ARRS: 37395 ORCID: I-9928-2014

RESEARCH INTERESTS

- Organic (Polymer) electronics
- Electronic skin (e-skin)
- Neuromorphic (cognitive/adaptive) architecture
- Device physics (OFETs, OPVs, memristors)
- Memristive systems (memristive synapses)
- Cognitive robotics
- Neuroscience (cognition)
- Smart (meta) materials
- Physically flexible electronics

EDUCATION AND RESEARCH

University of Tokyo, Tokyo, Japan **2015 – 2017**
Japanese Society for the Promotion of Science (JSPS) Research Fellow
Project: "Neuromorphic artificial organic e-skin for prosthetics and robotics application"
Supervisor: Prof. **Takao Someya**

University of Nova Gorica, Nova Gorica, Slovenia **2014 – 2015**
Postdoctoral Research Associate
Project: "Carrier mobilities in blends of organic semiconductors and graphene using transistor and time of flight measurement"
Supervisor: Prof. **Gvido Bratina**

University of Colorado, Boulder, CO, USA **2013 – 2014**
Postdoctoral Research Associate
Project: "Charge-transport measurements of organic semiconductors and liquid crystalline materials for OFETs and OPVs"
Supervisor: Prof. **Sean Shaheen**

University of Denver, Denver, CO, USA **2011 – 2013**
PhD in Engineering
Dissertation: "Fabrication and Application of A Polymer Neuromorphic Circuitry Based on Polymer Memristive Devices and Polymer Transistors"
Supervisor: Prof. **Richard Voyles** and Prof. **Sean Shaheen**
GPA: 3.78/4.0

Swiss Federal Institute of Technology (ETHZ), Zürich, Switzerland **2010 – 2011**
Graduate Research Internship
Research Topic: "Wireless Electrical Power to Sub-millimeter Robots"
Supervisor: Prof. **Bradley Nelson**

University of Denver, Denver, CO, USA **2008 – 2011**
M.S. in Computer Engineering
Thesis: "Simulation, Application, and Resilience of An Organic Neuromorphic Architecture,

Made with Organic Memristors and Organic Field Effect Transistors"
Supervisor: Prof. **Richard Voyles** and Prof. **Sean Shaheen**
GPA: 3.78/4.0

New Jersey Institute of Technology, Newark, NJ, USA **2001 – 2004**
B.S. in Computer Engineering
Areas of Concentration: Computer Communication
Supervisor: Prof. **Roberto Rojas-Cessa**
GPA: 4.0/4.0

WORK EXPERIENCE

Comcast Corporation, Greenwood Village, CO, USA **2006 – 2009**
TRAC Technician
Configuring and troubleshooting various types of VoIP problems relating to network, provisioning and customer issues.

Turner Engineering, Mountain Lakes, NJ, USA **2004 – 2006**
Network Engineer, Systems Engineer, IT
Maintaining in-house and client (AT&T, American Express) networks (LAN, DSL, cable), designing, implementing and maintaining firewalls (Cisco IOS), desktop support, small-scale programming. Designing, installing and maintaining remote-access file servers.

United States Postal Service, Jersey City, NJ, USA **1997 – 2004**
Distribution Clerk
Data Entry Operator. Sorting mail using automated mail sorters, loading and unloading trucks. Received a number of letters of commendation.

PUBLICATIONS

Nawrocki, R.A., Matsuhisa, N., Yokota, T., Someya, T., "300-nm Imperceptible, Ultraflexible, and Biocompatible e-Skin Fit with Tactile Sensors and Organic Transistors" **2016**
Advanced Electronic Materials

Nawrocki, R.A., Pavlica, E., Ćelić, N., Orlov, D., Mihailović, D., Bratina, G., "Fabrication of Poly(3-hexylthiophene) Nanowires for High-Mobility Transistors" **2016**
Organic Electronics

Nawrocki, R.A., Voyles, R.M., Shaheen, S.E., "Neurons in Polymer: Hardware Neural Unites based on Polymer Memristive Devices and Transistors" **2014**
IEEE Transactions on Electron Devices

Nawrocki, R.A., Galiger, E.M., Bailey, B.A., Ostrowski, D., Jiang, X., Voyles, R.M., Kopidakis, N., Olson, D.C., Shaheen, S.E., "An Inverted, Organic WORM Device Based on PEDOT:PSS with Very Low Turn-On Voltage" **2014**
Organic Electronics

Nawrocki, R.A., "Fabrication And Application of A Polymer Neuromorphic Circuitry Based on Polymer Memristive Devices and Polymer Transistors" **2014**
Doctor of Philosophy, University of Denver

Cui, Y., Voyles, R.M., **Nawrocki, R.A.**, Jiang, G., "The Morphing Bus: A New Paradigm in Peripheral Interconnect Bus" **2013**
IEEE Transactions on Components, Packaging and Manufacturing Technology

Nawrocki, R.A., Voyles, R.M., Shaheen, S.E., "Polymer and Nanoparticle-Composite Bistable Devices: Physics of Operation and Initial Applications" **2012**
Advances in Neuromorphic Memristor Science and Applications

Nawrocki, R.A., Shalaan, M., Shaheen, S. E., Lorenzon, N.M., "Monitoring Performance Degradation of Cerebellar Functions Using Computational Neuroscience Methods: Implications on Neurological Diseases" **2012**
Public Library of Science

Nawrocki, R.A., Frutiger, D. R., Voyles, R.M., Nelson, B. J., "Wireless Electrical Power to Sub-millimeter Robots" **2012**
IEEE International Conference on Intelligent Robotics and Automation

Nawrocki, R.A., "Simulation, Application, And Resilience of An Organic Neuromorphic Architecture, Made With Organic Bistable Devices And Organic Field Effect Transistors" **2011**
Master of Science, University of Denver

Nawrocki, R.A., Yang, X., Shaheen, S.E., Voyles, R.M., "Structured Computational Polymers for a Soft Robot: Actuation and Cognition" **2011**
IEEE International Conference on Robotics and Automation

Nawrocki, R.A., Shaheen, S.E., Voyles, R.M., "A Neuromorphic Architecture from Single Transistor Neurons With Organic Bistable Devices for Weights" **2011**
IEEE International Joint Conference on Neural Networks

Nawrocki, R.A., Voyles, R.M., "Artificial Neural Network Performance Degradation Under Network Damage: Stuck-At Faults" **2011**
IEEE International Joint Conference on Neural Networks

Nawrocki, R.A., Voyles, R.M., Shaheen, S.E., "Structured Computational Polymers for Safety, Security, and Rescue Robotics" **2011**
IEEE International Symposium on Safety, Security and Rescue Robots

Nawrocki, R.A., Voyles, R.M., Shaheen, S.E., "Simulating Hardware Neural Networks with Organic Memristors and Organic Field Effect Transistors" **2010**
Artificial Neural Networks In Engineering

Nawrocki, R.A., Voyles, R.M., Shalaan, M., "Monitoring Artificial Neural Network Performance Degradation Under Network Damage" **2010**
Artificial Neural Networks In Engineering

Nawrocki, R.A., Shaheen, S.E., Yang, X., Voyles, R.M., "Towards an All-Polymer Robot for Search and Rescue" **2009**
IEEE International Symposium on Safety, Security and Rescue Robotics

Nawrocki, R.A., Abisaleh, D., Rojas-Cessa, R., "Implementation of Scheduling Algorithms for Input-Queued Packet Switches: an Undergraduate Senior Project Experience" **2004**
Proceedings of the X Workshop, **Iberchip**

AWARDS AND HONORS

Japan Society for the Promotion of Science	**2015**
Habilitation from University of Nova Gorica	**2014**
University of Denver Fellowship	**2012, 2013**
University of Denver Best Teaching Assistant Award	**2012**
IEEE Safety Security and Rescue Robotics (SSR-RC) Symposium Best Paper Award	**2011**

National Science Foundation Scholarship **2010**
New Jersey Institute of Technology Summa Cum Laude Award **2004**
Union County Alumni Prize **2001**
Post-Day Memorial Award **2001**

TEACHING EXPERIENCE

University of Nova Gorica, Nova Gorica, Slovenia **2014 – 2015**
Teaching Assistant
Mathematical Physics II

University of Denver, Denver, CO, USA **2009 – 2012**
Graduate Teaching Assistant
Courses Taught: Electrical Circuits I & II, Engineering Concepts I, II & III, Digital Design, Engineering Applications, Engineering Analysis, Climate Science

New Jersey Institute of Technology, Newark, NJ, USA **2002**
Undergraduate Teaching Assistant
Courses Taught: Physics, Mathematics, Computers, Robotics, English, Chemistry, Electronics

SUPERVISED STUDENTS

Anže Peternel **2015 – 2015**
BS in Physics at University of Nova Gorica, Slovenia;
studied various surface treatments methodologies (such as Self-Assembling Monolayers) on organic semiconductors and their effects on carrier mobilites

Raveendra Babu Penumala **2014 – 2015**
PhD in Physics at University of Nova Gorica, Slovenia;
studied properties of charge carriers in pure organic semiconductors and blends of organic semiconductors with graphene

Jinta Mathew **2014 – 2015**
PhD in Physics at University of Nova Gorica, Slovenia;
studied properties of organic semiconductors using AFM, SEM and UPS characterization techniques

Eric Carlson **2014 – 2014**
PhD in Physics at University of Colorado in Boulder, CO, USA; studied physics concepts aiming at analyzing performance of artificial neural network during training

Matthew Wattwood **2014 – 2014**
MS in Computer Science at University of Denver, CO, USA; studied physics concepts aiming at analyzing performance of artificial neural network during training

Victor Palacios **2014 – 2014**
Sophomore Electrical Engineering at University of Colorado in Boulder, CO, USA;
studied surface and film morphology of spin and blade coated organic semiconductors in OFET and OPV arrangement

Jade Irizarry-Swordy **2013 – 2013**
Sophomore Electrical Engineering at University of Denver, CO, USA; studied bulk co-polymers, doped with fullerenes, with the aim of developing self-organizing organic memristive devices

Erin Galiger **2011 – 2013**
Senior Computer Engineering at University of Denver, CO, USA; studied AFM and thin film deposition of organic materials, with the goal of understanding how process conditions relate to film quality and device performance in organic photovoltaics and organic field effect transistors

Rachelle Cobb **2010 – 2011**
Senior Computer Engineering at Rose-Hulman, IN, USA;
studied fabrication and characterization of OLEDs, with the aim of encapsulating with standard polymeric materials

Ryan McDonald **2009 – 2009**
Senior Computer Engineering at University of Denver, CO, USA; studied fabrication and characterization of OLEDs, with the aim of encapsulating with standard polymeric materials

INVITED TALKS AND PRESENTATIONS

"300-nm and ultra-flexible, skin-compatible organic transistors, pseudo-CMOS and CMOS amplifiers for artificial skin in medical applications" **2016**
Materials Research Society (MRS)

"Organic electronics artificial e-skin for human, prosthetic, and robotic application" **2016**
Japanese Society for the Promotion of Science: Science Dialog

"Organic Field Effect Transistors: Device Architectures and Fabrication" **2014**
Organic Electronics Lecture at University of Colorado in Boulder

"Polymer Neuromorphic Circuitry: Biological Information Processing in Polymers" **2013**
Graduate Research Symposium at University of Denver

"Polymer Electronics for Low Power Conformable Displays" **2012**
Safety, Security and Rescue Robotics Workshop

"Memristive Synapses for Neuromorphic Systems" **2011**
Capo Caccia **Cognitive Neuromorphic Engineering Workshop**

"Towards an All-Polymer Robot for Search and Rescue" **2009**
Safety, Security and Rescue Robotics Workshop

POSTERS

"300-nm Highly Conformable Organic Thin Film Transistor" **2016**
International Thin-Film Transistor Conference (ITC)

"300-nm ultra-flexible and skin-compatible organic transistors for e-skin" **2016**
Symposium on Supramolecular Chemistry and Functional Materials (CEMSupra)

"Organic Semiconductors for Space Flight Applications" **2014**
AeroSpace Ventures Day at **University of Colorado in Boulder**

"PaperBots – Rapid Prototyping of Inexpensive Robots" and "Structured Computational Polymers" **2013**
Undergraduate Outreach at **Purdue University**

"Deposition of Organic Photovoltaic Thin Films via Blade-coating" **2012**
Undergraduate Outreach at **University of Denver**

VIDEO / MULTIMEDIA

"Laboratory of Organic Matter Physics; Overview" **GoTV** **2015**
(https://www.youtube.com/watch?v=FaWFtJL63e0)

"Can liquids think?" (given by *Richard Voyles*) **TEDxDU** **2011**
(http://tedxtalks.ted.com/video/TEDxDU-Richard-Voyles-Can-liqui)

REVIEWED JOURNALS & CONFERENCES

United States National Academy of Sciences: Proceedings of the National Academy of Sciences
IEEE: Transactions on Neural Networks; International Conference on Robotics and Automation; International Conference on Safety, Search and Rescue Robotics
Elsevier: Journal of Microelectronics
MIT Press: Neural Computing
ASME: Journal of Medical Devices; Artificial Neural Networks In Engineering

SKILLS / SOFTWARE / DEVICES

Physically flexible, 300-nm thin electronics: OFETs, Resistive sensors, Capacitors, Pseudo-CMOS & CMOS Inverters, Ring oscillators
Engineering (software) – MatLab, Mathcad, SPICE, LabView, NX, C, Perl
Devices – OFETs, OLEDs, OPVs, WORMs and OBDs (Organic memristors/Organic Resistive Memories), Organic Capacitors, Organic Resistors
Physics - AFM, SEM, UV-VIS, 2D and 3D photolithography, ToF, spin, blade and spray coating, screen printing, ZnO NP synthesis

LANGUAGES

English – speak, read, and write fluently
Polish – native language
Japanese – speak and read poorly
Slovenian – speak and read poorly
Russian – speak poorly

CERTIFICATE

Cisco Certified Network Associate (CCNA): Cisco ID CSCO11174973

MEMBERSHIPS

Institute of Electrical and Electronics Engineering (IEEE)
Materials Research Society (MRS)

REFERENCES

Takao Someya: Someya@ee.t.u-tokyo.ac.jp
Gvido Bratina: Gvido.Bratina@ung.si
Sean E. Shaheen: Sean.Shaheen@colorado.edu
Richard M. Voyles: rVoyles@purdue.edu
Nancy M. Lorenzon: Nancy.Lorenzon@du.edu
Kimon Valavanis: Kimon.Valavanis@du.edu