

Charles W. Van Neste

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Tennessee Technological University
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RESEARCH INTERESTS

Wireless and quasi-wireless power transmission and communication, multi-level inverter control and design, renewable power generation, instrumentation, sensing.

EDUCATION

- 08/2007 – 12/2009 Tennessee Technological University/Oak Ridge National Laboratory
Doctor of Philosophy, Electrical Engineering
“The Sound of Light: An Open Environment Photoacoustic Identification of Surface Adsorbed Residues”
Advisor: Thomas Thundat (ORNL) / Satish M. Mahajan (TTU)
- 08/2004 – 05/2006 Tennessee Technological University/Oak Ridge National Laboratory
Master of Science, Electrical Engineering
“A New Method for Collection of Molecular Vapor Using DC Corona Discharge”
Advisor: Thomas Thundat (ORNL) / Satish M. Mahajan (TTU)
- 08/1999 – 05/2004 Tennessee Technological University
Bachelor of Science, Electrical Engineering

TEACHING EXPERIENCE

08/2020 – present Tennessee Tech University Assistant Professor, ECE Department

Teaching:

- **ECE 3510: Electromagnetics 1** – Teaching Intro to Electromagnetics. Course incorporates in-person/online hybrid learning.
- **ECE 4961: Capstone Design 1** – Students are designing and fabricating a radio interferometry system with a goal of measuring the 1.4GHz spectral hydrogen lines (H I lines).
- **ECE 6980 Directed Study** – teaching a directed study project related to the wireless power and control of a string of servo motors

Advisement:

- Graduated two Master students in Dec. 2020
- Main graduate advisor to 4 Master students
- Committee member to 3 Ph.D. students.

08/2017 – 08/2020 Tennessee Tech University Research Assistant Professor

Teaching:

- **ECE 3510: Electromagnetics 1** – taught as part of a volunteer course in Spring 2019 semester. Class focused on key electrical concepts involving vector field analysis of static electric and magnetic fields starting with

Coulomb's law and progressing to a basic introduction/derivation of electromagnetic waves. Course utilized material from Sadiku, Kraus/Carver, Griffiths, and Jefimenko and followed ABET criteria.

- **ECE 4933 Research Topics** – taught students proper research and developed skills on the following projects:
 - 1) wirelessly powered and controlled robotic linkage
 - 2) single wire no return communication methodology
- **ECE 6980 Directed Study** – taught graduate student in the following research topic area
 - 1) high frequency inverter topologies related to WPT

Lectures:

- **Tennessee Tech Uni. Dead-hour Lectures** – gave several lectures to IEEE student chapter detailing research with WPT technology including demonstrations.
- **University of Cambridge, United Kingdom** – gave invited lecture on my current WPT program at TTU.

Advisement:

- Undergraduate advisor for 5 ECE students
- Main graduate advisor to 3 Master students and 1 Ph.D. student,
- Committee member to 3 Ph.D. students.

01/2011 – 06/2017 Canada Excellence Research Chair Research Associate

Teaching:

- **ECE 490/491 EE Design Project 1 and 2** – Equivalent to a Capstone project, taught the senior design project where students developed a wirelessly powered cell phone charger using my WPT technology.
- **Laboratory Protocols** – developed laboratory protocols and training modules for students working in the lab.

Lectures:

- Presented Lectures to Chemical and Materials Engineering Department on reactive power flow and resonant systems related to oil sands processing and tailings water separation.

Advisement:

- Undergraduate mentoring for Chemical and Electrical Engineering students
- Graduate mentoring for Chemical and Materials Engineering students.

RESEARCH EXPERIENCE

08/2020 – Present Tennessee Tech University Assistant Professor, ECE Department

- Teaching electromagnetics courses and developing an externally funded program for novel wireless power transfer technologies.

08/2017 – 08/2020 Tennessee Tech University Research Assistant Professor

- Developing externally funded program for novel wireless power transfer technologies to enable the operation of networked agricultural sensing, electronic device and vehicle electrification. Total funding procured for TTU to was \$1,237,500.

01/2011 – 06/2017 Canada Excellence Research Chair Research Associate

- Invented quasi-wireless transmission technique for the operation of electric loads over conducting and semi-conducting surfaces – including the earth's surface
- Used quasi-wireless technology to power and communicate with multiple robotic devices over surfaces with key vision to construct robotics fully wireless, using robot chassis for power and comms.
- Developed resonant standing-wave heating system for mature fine tailings separation, water evaporation, and in situ bitumen recovery.
- Mentored graduate students throughout thesis and taught proper laboratory protocols
- Developed and mentored undergraduate capstone projects

01/2010 – 12/2010 Oak Ridge Associated Universities Post Doctorate

- Solved key issues to standoff explosive detection techniques allowing more realistic operation in outdoor environments.
- Developed technique to greatly enhance the quality factor of photodetector devices for the detection of IR (standoff and point sensing architectures).

08/2006 – 12/2009 Oak Ridge Associated Universities Post Master

- Full time (40 hr/week) employment at ORNL in addition to full time Ph.D. student at Tennessee Tech University.
- Invented new standoff technique for identification of surface residues at 100 ng/cm² concentrations.
- Invented point-sensing spectroscopy technique for selective detection of molecular vapors.
- Developed mechanical resonator for wide-band optical detection.
- Invented electrical generator which functions independent of magnetic polarity with doubled frequency.

07/2004 – 08/2006 Graduate Research Assistantship

- Developed technique which utilized electrical corona to concentrate water vapor from the ambient environment.
- Worked on micro-cantilever detection system based on functionalized coatings.

AWARDED FUNDING

U.S. Army Tank Automotive Research, Development and Engineering Center:

Adaptive and Reconfigurable Sensor Elements and Networks for Monitoring Critical Infrastructure and Maneuver Corridors (ETO NO.: TO 008)

Lead PI

Total Funding Awarded: \$1,000,000

Funding Awarded to TTU: \$1,000,000

Duration: 10/10/2019 – 10/09/2020

National Science Foundation:

Signals in the Soil (DCL 18-047)

Lead PI

Total Funding Awarded: \$300,000

Funding Awarded to TTU: \$175,000
Duration: 10/01/2018 – 09/30/2020

Tennessee Valley Authority (TVA)

Lead PI
Total Funding Awarded: \$50,000
Funding Awarded to TTU: \$50,000
Duration: 06/07/2019 – 09/30/2019

Animus Ventures Pvt Ltd.

Lead PI
Total Funding Awarded: \$12,500
Funding Awarded to TTU: \$12,500
Duration: 08/01/2018 – 12/31/2018

SOFTWARE EXPERIENCE

Altium: PCB Design Software
LTSpice
LabVIEW
MATLAB Simulink
Microsoft Office
Adobe Photoshop

FLUENT LANGUAGES

English
American Sign Language

PATENTS (underline indicates Students)

(TTU) Charles W. Van Neste

Method and Apparatus for Generating Electric Based Soliton Waves in Natural Terrestrial Environments

Provisional Patent Application Filed.

App. No: 63/107,575

Filing Date: October 30, 2020

(TTU) Charles W. Van Neste, Tanner Mingen, Whitney Kirby

Electric Field Shaping and Confining Wireless Power Transfer System

Approved for Full Patent Filing

App. No: 62/912110

Filing Date: 08/10/2019

(TTU) Charles W. Van Neste, Charles A. Robinson, Brandon Childress

Omni Directional Electric Near-field Distance Sensing

Approved for Full Patent Filing

App. No: 16/839015

Filing Date: 04/02/2019

(TTU) Charles W. Van Neste

Luxating Inverter for Wide-band Wireless Power Transfer

US/Canada Patent Pending
App. No: 62/684,002
Filing Date: 06/12/2018

(UA) Charles W. Van Neste, Thomas G. Thundat, John E. Hawk, Richard Hull, Jonathan Backs,
Arindam Phani, Nurichi Guseynov
Electrical Energization and Transmission
US Patent No. **10,622,839**
Filing Date: 11/08/2013

(ORNL) Charles W. Van Neste
Multi-winding Homopolar Electric Machine
US Patent No. **8,288,910**
Filing Date: 07/16/2012

(ORNL) Charles W. Van Neste, Lawrence R. Senesac, Thomas G. Thundat
Acoustic Enhancement for Photo Detecting Devices
US Patent No. **8,378,286**
Filing Date: 07/16/2010

(ORNL) Charles W. Van Neste
Multi-winding Homopolar Electric Machine
US Patent No. **8,247,942**
Filing Date: 06/21/2010

(ORNL) Charles W. Van Neste, Marissa E. Morales-Rodriguez, Larry R. Senesac, Thomas G.
Thundat
Standoff Spectroscopy Using a Conditioned Target
US Patent No. **8,080,796**
Filing Date: 6/30/2010

(TTU) Charles W. Van Neste, Wenzhong Gao
Wind Aeolipile
US Patent No. **8,591,174**
Filing Date: 11/19/2009

(ORNL) Charles W. Van Neste, Arpad Vass, Thomas G. Thundat
External Split Field Generator
US Patent No. **8,120,225**
Date: 06/04/2009

(ORNL) Charles W. Van Neste, Arpad Vass, Thomas G. Thundat
Internal Split Field Generator
US Patent No. **8,089,188**
Date: 06/04/2009

(ORNL) Thomas G. Thundat, Charles W. Van Neste, Gilbert M. Brown, Lawrence R. Senesac
Photoacoustic Microcantilevers
US Patent No. **8,194,246**
Filing Date: 06/19/2009

(ORNL) **Charles W. Van Neste**, Lawrence R. Senesac, Thomas G. Thundat
Reverse Photoacoustic Standoff Spectroscopy
US Patent No. **7,924,423**
Filing Date: 08/11/2008

(ORNL) **Charles W. Van Neste**, Lawrence R. Senesac, Thomas G. Thundat
Photoacoustic Point Spectroscopy
US Patent No. **7,961,313**
Filing Date: 08/11/2008

REFEREED JOURNAL PUBLICATIONS (underline indicates Students)

Charles A. Robinson, Hao Lu, **C.W. Van Neste**, “*Capactive Omnidirectional Position Sensor Using Heterogenous Transmission Line Mechanics*,” IEEE Sensors Journal, Accepted with Revisions (2020).

M. E. Bima, I. Bhattacharya and **C. W. Van Neste**, "Experimental Evaluation of Layered DD Coil Structure in a Wireless Power Transfer System," in IEEE Transactions on Electromagnetic Compatibility, vol. 62, no. 4, pp. 1477-1484, Aug. (2020), doi: 10.1109/TEMPC.2020.3002694.

Utkarsh D. Kavimandan, Satish M. Mahajan, **C. W. Van Neste**, “Analysis and Demonstration of a Dynamic ZVS Angle Control using a Tuning Capacitor in a Wireless Power Transfer System”, IEEE J. of Emerging and Selected Topics in Power Electronics, (Early Access) (2020). 10.1109/JESTPE.2020.2997822

C.W. Van Neste, Thomas Thundat, Ajit Khosla, Sarah Szanton, and Larry, A. Nagahara, “*Perspective—Maintaining the Quality of Life in Depopulating Communities: Expanding Smart Sensing via a Novel Power Supply*,” J. Electrochem. Soc. Vol. 167, No. 3, (2020).

Lixiang (Jackie) Zou, Qi Zhu, **C.W. Van Neste**, Aiguo (Patrick) Hu, “*Modelling Single-Wire Capacitive Power Transfer System with Strong Coupling to Ground*,” IEEE Journal of Emerging and Selected Topics in Power Electronics, (2019).
doi: 10.1109/JESTPE.2019.2942034

Amirreza Sohrabi, Ghazaleh Haghghat, Parmiss Mojir Shaibani, **C.W. Van Neste**, Selvaraj Naicker, Mohtada Sadrzadeh, Thomas Thundat, “*Degradation of pharmaceutical contaminants in water by an advanced plasma treatment*.” Desalination and Water Treatment, Vol. 139, 202-221, (2019).

Amirreza Sohrabi, Ghazaleh Haghghat, Parmiss Mojir Shaibani, **Charles William Van Neste**, Selvaraj Naicker, Mohtada Sadrzadeh, Thomas Thundat, “*Elimination of pharmaceutical contaminants fluoxetine and propranolol by an advanced plasma water treatment*.” Desalination and Water Treatment, Vol. 113, 346-353, (2018).

Ghazaleh Haghghat, Amirreza Sohrabi, Parmiss Mojir Shaibani, **C. W. Van Neste**, Selvaraj Naickera, Thomas Thundat, “*The role of chloride ions in plasma-activated water treatment processes*,” Environ. Sci.: Water Res. Technol., **3**, 156-168 (2017).

C.W. Van Neste, Richard Hull, J.E. Hawk, Arindam Phani, M.J. Unsworth, T. Thundat,

“Electrical Excitation of the Local Earth for Resonant, Wireless Energy Transfer,” Wireless Pwr. Transfer, Vol. 4, pp. 1-9, Sept. (2016).

Tinu Abraham, **C.W. Van Neste**, Artin Afacan, Thomas Thundat, *“Dielectric Relaxation-Based Capacitive Heating of Oil Sands,”* Energy Fuels, Vol. 30 (3), pp. 1987-1996, (2016).

A.K. Pickering, R. Hull, J.E. Hawk, A. Phani, **C. W. Van Neste**, T. Thundat, *“Quasi-wireless surface power and control for battery-free robotics,”* Wireless Pwr. Transfer, Vol. 2, pp. 134-142, Sept. (2015).

C. W. Van Neste, J.E. Hawk, A. Phani, J.A.J. Backs, R. Hull, T. Abraham, S.J. Glassford, A.K. Pickering, T. Thundat, *“Single-contact transmission for the quasi-wireless delivery of power over large surfaces,”* Wireless Pwr. Transfer, Vol. 2, pp. 1-8, Oct. (2014).

Dongkyu Lee, Seonghwan Kim, **C. W. Van Neste**, Moonchan Lee, Sangmin Jeon, and Thomas Thundat, *“Photoacoustic spectroscopy of surface adsorbed molecules using a nanostructured coupled resonator array,”* Nanotechnology, ” **25**, 035501 (2014).

Xunchen Liu, **Charles W. Van Neste**, Manisha Gupta, Ying Y. Tsui, Seonghwan Kim, and Thomas Thundat, *“Standoff Reflection-Absorption Spectra of Surface Adsorbed Explosives Measured with Pulsed Quantum Cascade Lasers,”* Sensors and Actuators: B. Chemical, **191**, 450-456, (2013).

S. Kim, D. Lee, X. Liu, **C. Van Neste**, S. Jeon, and T. Thundat, *“Molecular recognition using receptor-free nanomechanical infrared spectroscopy based on a quantum cascade laser”*, Sci. Rep., 3, 1111, (2013).

C. W. Van Neste, Liu, X., Gupta, M., Kim, S., Tsui, Y., and Thundat, T., *“Standoff detection of explosive residues on unknown surfaces,”* SPIE Micro- Nano Sensors, Systems, and App. IV, 8373 83732F, (2012).

C. Guthy, **C.W. Van Neste**, S. Mitra, S. Bhattacharjee, and T. Thundat, *“Parametric energy conversion of thermoacoustic vibrations”*, Appl. Phys. Lett., 100, 203902, (2012).

M.E. Morales-Rodriguez, **C.W. Van Neste**, L.R. Senesac, S.M. Mahajan, and T. Thundat, *“Ultra violet decomposition of surface adsorbed explosives investigated with infrared standoff spectroscopy”*, Sens. and Actuators, B: Chemical, 161, pp. 961-966, (2012).

C.W. Van Neste, M.E. Morales-Rodriguez, L.R. Senesac, S.M. Mahajan and T. Thundat, *“Quartz crystal tuning fork photoacoustic point sensing”*, Sens. and Actuators, B: Chemical, 150 (1), pp. 402- 405, (2010).

C.W. Van Neste, L.R. Senesac, T. Thundat, *Standoff Spectroscopy of Surface Absorbed Chemicals*, Anal. Chem., vol. 81, No. 5, pp. 1952-1956, (2009).

C.W. Van Neste, L.R. Senesac, T. Thundat, *Standoff photoacoustic spectroscopy*, Appl. Phys. Letters, Vol. 92, (2008).

Thomas Thundat, L.R. Senesac, **C.W. Van Neste**, A. Krause, E. Finot, *Photothermal Spectroscopy using Microfabricated Cantilever Sensors*, ECS Trans., 16(11), (2008).

C.W. Van Neste, L.R. Senesac, D. Yi, T. Thundat, *Standoff detection of explosive residues using photothermal microcantilevers*, Appl. Phys. Letters, Vol. 92, (2008).

A. R. Krause, **C. W. Van Neste**, L. R. Senesac, T. Thundat, and E. Finot, *Trace explosive detection using photothermal deflection spectroscopy*. J. Appl. Phys. **103**, 094906, (2008).

BOOK CHAPTERS

C.W. Van Neste, L.R. Senesac, A.R. Krause, and T. Thundat, “*Photothermal Sensing of Chemical Vapors Using Microcantilevers*” Nanoscale Science and Technology Applications in Electronics, Photonics, Sensing and Renewable Energy, Edited by A. Korkian (Springer 2010).

CONFERENCE PUBLICATIONS (underline indicates Students)

Charles R. Robinson, Brandon T. Nieman, Robert Craven, Muhammad Enagi Bima, **C. W. Van Neste**, “Development of a Wireless Power Transmission System for Agriculture Sensor Devices”. IEEE Int. Conf. on Big Data 2020, Atlanta, GA, USA (2020) (Oral, Article)

Maci M. Arms, Kayla H. Truman-Jarrell, **C. W. Van Neste**, “*Investigating the Interactions between Capacitive Wireless Power Transfer and Concrete.*” IEEE WPW, Soel, South Korea (2020) (Oral, Article)

Michael Robert Coultis, Jonathan Dean, **C.W. Van Neste**, “*Capacitive Powered Sensor Network using a Series Transmission Line.*” IEEE WPW, Soel, South Korea (2020) (Oral, Article)

Charles A. Robinson, Hao Lu, **C.W. Van Neste**, “*Omnidirectional Vehicle Sensing for Wireless Power Transfer Applications.*” IEEE WPW, London, United Kingdom (2019) (Oral, Article)

Donald Chaney, Charles A. Robinson, **C.W. Van Neste**, “*Quarter Wavelength Surface Structures for Improved Operation in Unipolar Capacitive Power Transfer.*” IEEE WPW, London, United Kingdom (2019) (Oral, Article)

Utkarsh D. Kavimandan; **C. W. Van Neste**; Satish M. Mahajan; “*Luxating Inverter for an Inductive Power Transfer System.*” IEEE IECON Indus. Elect. Soc., Washington DC, USA (2018) (Oral, Article)

C. W. Van Neste, Utkarsh D. Kavimandan, Satish M. Mahajan, “*Luxating Inverter for Wide-band Wireless Power Transfer,*” IEEE PELS Workshop on Emerging Technology: Wireless Power, Montreal, Canada (2018) (Oral, Article)

Utkarsh D. Kavimandan; Satish M. Mahajan; **C. W. Van Neste**, “*Dual independent control for inductive wireless power transfer,*” 2018 IEEE International Conference on Industrial Power Electronics for Sustainable Energy Systems (IESES), Hamilton, New Zealand (2018) (Oral, Article)

C. W. Van Neste, Arindam Phani, Allison Larocque, J.E. Hawk, Radhika Kalra, M.J. Banaag, Malina Wu, Thomas Thundat, “*Quarter Wavelength Resonators for use in Wireless Capacitive Power Transfer,*” IEEE PELS Workshop on Emerging Technology: Wireless Power, Chongqing, China (2017) (Oral, Article)

C. W. Van Neste, Arindam Phani, Richard Hull, J.E. Hawk, Thomas Thundat, “*Quasi-Wireless Capacitive Energy Transfer for the Dynamic Charging of Personal Mobility Vehicles*,” IEEE PELS Workshop on Emerging Technology: Wireless Power, Knoxville, TN (2016) (Oral, Article)

C. W. Van Neste, Richard Hull, Tinu Abraham, J.E. Hawk, Arindam Phani, Thomas Thundat, “*Wireless Single Contact Power Delivery*,” IEEE Wireless Pwr. Transfer Conf., Boulder, CO (2015) (Poster, Article)

Inseok Chae, **C. W. Van Neste**, Thomas Thundat, “*Ozone alteration for background references using QCL based mid infrared standoff spectroscopy*,” SPIE Defense, Security, and Sens. Baltimore, MA (2015) (Oral, Article)

Tinu Abraham, Rohan Gaikwad, Aharnish Hande, **C. W. Van Neste**, J.E. Hawk, Arindam Phani, Artin Afacan, Thomas Thundat, “*In Situ Heating of Oil Sands Using an Electrical Standing Wave Resonance Excitation Approach*,” World Heavy Oil Congress, Edmonton, AB (2015)

C.W. Van Neste, X. Liu, M. Gupta, S. Kim, Y. Tsui, and T. Thundat, “*Standoff detection of explosive residues on unknown surfaces*” Conference on Micro- and Nanotechnology Sensors, Systems, and Applications IV Location: Baltimore, MD Date: APR 23-27, 2012 Proceedings of SPIE Volume: 8373 Article Number: 83732F (Oral, Article)

C.W. Van Neste, S.M. Mahajan, *Wireless Reactive Power Transfer for Off-shore Energy Harvesting*, International Conference for Clean Electric Power – IEEE Proceedings, Capri, Italy, June 9-10, 2009 (Oral, Article)

C.W. Van Neste, S.M. Mahajan, T. Thundat, *Wireless Reactive Power Transfer through the Natural Media*, Materials Research Society, Boston, MA, Dec. 1-5, 2008 (Poster)

C.W. Van Neste, L.R. Senesac, A. Vass, T. Thundat, *Carbon Nanotube Structures for Cellular Photoacoustic Identification*, Materials Research Society, Boston, MA, Dec. 1-5, 2008 (Oral)

SCHOLARLY ACTIVITIES

Guest Editor: Applied Sciences

Guest Editor: IEEE Journal of Emerging and Selected Topics in Power Electronics

Reviewer: IEEE Transactions on Industrial Electronics

Reviewer: IEEE Transactions on Power Electronics

Reviewer: Energies Open Access Journal

Reviewer: Wireless Power Transfer Journal

Conference Reviewer: 2020 IEEE Wireless Power Week Korea

Session Chair: 2018 IEEE International Conference on Industrial Electronics for Sustainable Energy Systems

Session Chair: IEEE Workshop on Wireless 2018

PRESS RELEASES / NEWS MEDIA

“Power transmission through soil” – *CTV Edmonton News* (Local TV News) – March 2017

“New Technology could make cord phone chargers obsolete” – *Global Edmonton Interview* (Local TV News) – March 2017

“Ingenuity Lab’s technology could transform agriculture and save the planet” – *The New Economy* – June 2016.

“Sensors can detect anything from oil sands to Zika virus” – *Globe and Mail* – May 2016

“U of A developing wireless electricity transmission” – *Edmonton Journal* – Mar. 2014

“OPTICAL SENSING: Laser-acoustic device detects explosive residue from a safe distance” – *Laser Focus World* – Sept. 2008

“Detecting Explosives at a Distance with Light” – *Photonics Spectra* – Sept. 2008.

“The war on terror is shrinking” – *MSNBC.com* – Aug. 2008.

“Super-sensitive Explosive Detector Demonstrated” – *Science Daily* – June 2008

“Laser-based sensor detects explosives from 20 yards away” – *Laser Focus World* – June 2008.

AWARDS

2019 Wings Up 100 Research Achievement Award

2019 IEEE Wireless Power Week London, First Place for Best Talk

2008 Oak Ridge National Laboratory Key Contributor Award, Technology Transfer for Reverse Photo-Acoustic Spectroscopy

2008 Bio-Science Division Distinguish Achievement Post-Graduate Award, Oak Ridge National Laboratory