Joel **Castro**

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Education

PhD in Electrical & Computer Engineering — *Orono, ME*
University of Maine — *Sep 2013 – May 2020*
GPA: 3.63 — Leak Detection and Localization in Pressurized Space Structures Using Bayesian Inference: Theory and Practice

MS in Electrical Engineering — *Orono, ME*
University of Maine — *Sep 2011 – May 2013*
GPA: 3.42 — Leak Detection and Localization In Inflatable Structures Using Bayesian Inference

BS in Electrical & Computer Engineering — *Orono, ME*
University of Maine — *Sep 2007 – May 2011*
GPA: 2.92

Work Experience

Gradutate Research Assistant — *Orono, ME*
WiSe-Net Lab, UMaine — *Jan 2012 – May 2020*
- Light Lab Management
- Lead on several projects
- Assisted on numerous other projects
- Mentored/assisted undergrads, newer graduates, and some high school students

Lab TA: Random Signal Analysis — *Orono, ME*
Dept. of Electrical and Computer Engineering, UMaine — *Jan 2013 – May 2013*
- Maintaining and preparing lab hardware and software
- Instructed students in procedures and troubleshooting

Intern: Avionics Division of Engineering Directorate — *Houston, TX*
NASA Johnson Space Center — *May 2012 – Jul 2012*
- Assisted in continuing development of modular instrumentation systems for wireless sensor networks
- Worked on drivers and software for aggregation and represention of distributed data

Teacher Assistant (TA): Scientific Ballooning — *Orono, ME*
Dept. of Electrical and Computer Engineering, UMaine — *Jan 2011 – May 2011*
- Assist first and second year students with application of Electrical and Computer Engineering
- Assisted with two launches and recoveries with live measurements

Undergraduate Research Assistant — *Orono, ME*
WiSe-Net Lab, UMaine — *Jun 2010 – May 2011*
- Primarily worked on a Wireless Monitoring Project.
- Some assistance to other undergraduates

Substitute Teacher — *Old Town, ME*
Maine RSU 34 — *Oct 2009 – Feb 2011, Jan 2016 – Jun 2017, Jan 2023 – Jun 2024*
- Primarily worked in secondary education will an occasional stint in elementary
- Executed complete lesson plans in STEM fields and English

Student Tutor II — *Orono, ME*
FYRE Program, UMaine — *Sep 2009 – May 2010*
- Primarily responsible for students needing assistance with Maths up to Calulus III
- Helped with Physics, Chemistry, and some English courses

Skills

Languages:	MATLAB, C, C++, Python, SQL, PHP, JavaScript, C#
Software:	MCU[PIC,STM32,C2000], Arduino, MySQL, Eagle, AutoCAD
Hardware:	Soldering, Circuit Design, PCB Design, 3D Printing

Work Projects

Non-invasive Brain Injury Detection
C, Circuit Design, PCB Design, CAD Design, 3D Printing

Wireless Senor Mattress System (Jan 2015 — Jan 2020) *https://sites.google.com/view/activas-diagnostics*

Prototype PCB and case was designed and built for two-point monitoring of sleep movement. Original software for sensor read, storage, and transmission was written. A complete deployable test model with case was designed and built to monitor additional points. Data from test subjects was passed on for use in algorithms for dectecting possible brain injury and more. Regular assistance and repair with the device as well as work on future models was also done.

Wireless Leak Detection System for Space Structures
MATLAB

Lead; Simulation and Analysis of Reflection Effects on WLD (Jun 2018 — Feb 2020) *http://digitalcommons.library.umaine.edu/etd/3179*

A simulation of the physical acoustics at the senors was created to model the Wireless Leak Detection system deployed to the ISS. The model was then subjected to a wide range of single reflection multipath interference. Data collected were used to determine tolerable reflection surface proximity and in the future help in localization with known surface when deployed.

Vehicle Detection Research
C, Circuit Design

Co-Lead; Sensor Node for Motion/Proximity Detection (Jan 2019 — Sep 2019) *https:/castrocorp.me/projects/VDR.html*

A prototype of a sensor node for detecting and differentiating vehicles was designed, built, and tested. Raw data from testing was passed on to be used in application of machine learning for further development.

Wireless Leak Detection System for Space Structures
C, C++, MATLAB

Co-Lead; Leak Localization Software and Data Analysis
(Sep 2014 — Dec 2015; Jan 2017 — May 2018) *http://digitalcommons.library.umaine.edu/etd/3179*

Base software for an Arduino based sensor node was developed to rapidly collect ultrasonic samples and then process possible leak locations. Flight-ready hardware was launced for testing aboard the ISS. Data collected were used with the localization algorithm to visualize possible leak locations relative to the nodes. Further work to define ambient noise levels and threshold for the algorithm were ongoing.

Stormwater Management Research Team Monitoring System
C, C++, MySQL, Circuit Design, PCB Design, Education

Lead; WSN for High School STEM Education (Oct 2013 — Sep 2016) *https://umaine.edu/smart/*

A prototype sensor node was developed to record and transmit data from sensors specific to water quality. The design was further modified onto an Arduino base to enable inexperienced high school students to build with teacher guidance. A deploy-ready version of the sensor nodes, router nodes, and basestation were built. During a week-long camp every summer, students were taught the basics of building the boards including soldering and some simplified coding. Deployment at several areas of interest across Maine were conducted with help from local water districts. Data collected from during the project by students were collected in a central datbase for management and freely accessible data.

Wireless Sensor Network for Real Time Control of Launch Vehicles
C,Flight Testing

WSN for Vibration Monitoring (Sep 2012 — May 2014) *https://ieeexplore.ieee.org/document/6737575*

Accelerometers were added to low power flight-ready senor nodes to transmit raw data to a basestation. Test flights were conducted at CSU Long Beach to test and record sample data for further development of thruster control via feedbcak system.

Orthogonal Physical Layer Network Coding vs. Pollution Attack
MATLAB

Co-Lead; Simulation of Pollution attacks on base OPLNC Network
(Sep 2012 — Mar 2013) *https://jwcn-eurasipjournals.springeropen.com/articles/10.1186/s13638-016-0788-9*

A model of the orthogonal PLNC was built to replicate sycnchronous transmissions between two standard nodes with a routing node. Simulations of pollution attacks were conducted to gauge the effect they can have on the newer method of PLNC.

Modular Integrated Stackable Layers (MISL)
C, Python

Network Topology Mapping (May 2012 — Jul 2012) *https://www.nasa.gov/centers/johnson/engineering/projects/modular_instrumentation_system/index.html*

Firmware for wireless layer was modified to enable local relationship data gathering and base node agregation. These data were then used to plot a visual representation of the current network along with basic sensor data from a sensor layer.

Wireless Leak Detection Hardware System
MATLAB, Circuit Design

Lead; Leak Detection Proof of Concept (Feb 2012 — Sep 2012) *http://digitalcommons.library.umaine.edu/etd/3179*

Arrangements of ultrasonic transducer and sensors were tested for physically simulating and detecting gaseous leaks. Once determined, the raw data was used to test the detection algorithm.

Wireless Leak Detection Software
MATLAB

Leak Detection from tracking (Jan 2012 — Jan 2013) *https://ietresearch.onlinelibrary.wiley.com/doi/pdf/10.1049/iet-wss.2012.0137*

Software developed for tracking was modified to be used for simple localization. Tracking software provided an effective method of determing presence of leak that was computationally simple to add to necessary tracking.

Optimal DSSS Code Selection for SAW Multi-Sensor Systems *MATLAB*

Orthogonal Codeset Generation (Sep 2011 — Jan 2012) *ieeexplore.ieee.org/document/6243730*

Principles of orthognonality of codes were used to generate codesets with minimum cross-correlation based on user needs.

Wireless Sensing for Teaching Modules *C#, MATLAB*

Wireless Fading Demo using RFID (Jun 2011 — Aug 2011; Sep 2012 — Mar 2013) *https:/castrocorp.me/projects/WTSM.html*

Simple code for a Windows Mobile Based RFID reader was modified for ID registration and packet recording. Collected data was then used to generate a relationship between packet loss and relative distance to a given ID.

Wireless Temperature Monitoring System *C,MATLAB,PHP/HTML,Javascript,MySQL*

Co-Lead; Wireless sensor network (Jul 2010 — May 2011) *https:/castrocorp.me/projects/WTMS.html*

Wireless sensor network set up to monitor temperature and humidity in portion of Barrows Hall with aggregated data and presentation. Last task was implementing control of external hardware.

Published Works

Wireless Sensing of Pressurized Space Structures *March 2021*

J. Castro, L. Labonte, C. Clark, H. Roufarshbaf and A. Abedi *IEEE Journal of Radio Frequency Identification*

On robustness of physical layer network coding to pollution attack *January 2017*

M. Razfar, **J. Castro**, A. Abedi. *EURASIP Journal on Wireless Communications and Networking*

Wireless Leak Detector for International Space Station (WiLD-ISS) *July 2015*

A. Abedi, V. Caccese, **J. Castro**, C. Clark, L. Labonte, H. Roufarshbaf *ISS R&D Conference*

Wireless leak detection using airborne ultrasonics and a fast-Bayesian tree search algorithm with technology demonstration on the ISS *2015*

C. Clark, L. Labonte, **J. Castro**, A. Abedi and V. Caccese *IEEE International Conference on Wireless for Space and Extreme Environments*

Macro- and Micro-Movement Device for Detection of Abnormal Sleep-related Spontaneous Movement Patterning Associated with Neurological Injury *November 2013*

J. Castro, A. Abedi, F. Schwaner, J.A. Paul, H. Shrestha, M.J. Hayes *Maine Chapter of the Society for Neuroscience*

Sub-optimum fast Bayesian techniques for joint leak detection and localisation *September 2013*

H. Roufarshbaf, **J. Castro**, F. Schwaner and A. Abedi *IET Wireless Sensor Systems*

Wireless sensor and actuator networks with delayed noisy feedback (WiSAN) *2013*

L. Labonte et al. *IEEE International Conference on Wireless for Space and Extreme Environments*

Stochastic modeling of leak detection and localization using ultrasonic sensor array *2013*

H. Roufarshbaf, **J. Castro** and A. Abedi *IEEE International Conference on Wireless for Space and Extreme Environments,*

Determination of elastic mode characteristics using wirelessly networked sensors for nanosat launch vehicle control *2013*

R. Razaei et al. *IEEE International Conference on Wireless for Space and Extreme Environments*

Wireless network design and analysis for real time control of launch vehicles

M. Razfar et al.

2013

IEEE International Conference on Wireless for Space and Extreme Environments

Techniques for Optimal DSSS Code Selection for SAW Multi-Sensor Systems

A. T. Hines, D. Y. G. Tucker, J. H. Hines, **J. Castro**, A. Abedi

May 2012.

IEEE International Frequency Control Symposium