

Boston Section

Supporting students, working engineers and retirees through professional development, education and resources.

THE Reflector

ISSUE #2
FEBRUARY 2024

2024 IEEE INTERNATIONAL
SYMPOSIUM ON PHASED
ARRAY SYSTEMS AND
TECHNOLOGY

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Boston Section

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Fusion Energy

by Dr. Thaddeus Kochanski and Lennart Long

Within the last two years Fusion has lit up the popular media, the business publications, as well as scientific journals – but the concept of Fusion and indeed its commercial application is just over hundred years old. Once radioactivity and atomic nuclei were discovered, astronomers and physicists once again asked “what powers the sun?”

In 1920, Sir Arthur Eddington presented “The Internal Constitution of the Stars” to the British Association for the Advancement of Science in Cardiff. His key observations can be considered the beginning of the Thermonuclear Age: “A star is drawing on... subatomic energy... in all matter; we sometimes dream that man will one day learn how to release it and use it for his service. The store is well-nigh inexhaustible, if only it could be tapped. “* In 1923, Eddington told us to consider the fusion of hydrogen. Hans Bethe would receive the Nobel Prize for his work in 1939 on “Energy Production in Stars.” From 1933-1934, the Rutherford laboratory accelerated protons and deuterons with high DC voltages [100-500 KV] and demonstrated the first fusion of d-d, yielding neutrons, alpha particles and tritons in various combinations – they were, “surprised to find that... an enormous effect was produced” *.

Thus, at the beginning of WWII both the theoretical and preliminary experimental underpinnings of Fusion had been established. Of course, harnessing nuclear fission, demonstrated by the late 1930's, seemed easier. However, even before the first nuclear weapons, interest turned to creating a “Super” using a fission device to initiate fusion. However, theory indicated that neither heat, nor direct compression would work. Theoretical work by Edward Teller and Stanislaw Ulam at Los Alamos, and independently by Andrei Sakharov in the Soviet Union, described a Staged Thermonuclear device. X-rays from the “primary fission device” ablated materi-

al from the pusher surrounding the fusion fuel mix in the remote “secondary.” Laser Inertial Confinement Fusion originally proposed by John Nuckolls, Kidder and others at Lawrence Livermore National Laboratory [“LLNL”] in the early 1960's adopted this staging -- eventually leading to “Ignition” announced in December 2022 by the NIF team at LLNL*.

On November 1, 1952, the Teller–Ulam configuration was tested in the “Ivy Mike” shot on an island in the Enewetak atoll with a yield of 10.4 Megatons of TNT (44 PJ), using a cryogenic liquid deuterium fuel for the secondary. Meanwhile, physicists had been speculating on how to “ignite and burn” fusion fuel using a strong magnetic field to “confine” the particles. All that was needed was to heat the plasma “sufficiently” and you would have fusion.

The first patent for an actual “fusion reactor” was filed in 1946 in the UK, “A toroidal vessel containing a fuel gas at low density... [with] an electron current of about 500,000 amps...maintained in equilibrium partly by its own magnetic field and partly by a magnetic field of about 1500 gauss applied perpendicular to the plane.” Alan A. Ware’s experiments at Imperial College, London, UK in 1947 resulted in the first Ph.D. for controlled thermonuclear fusion. Within a few years British toroidal devices of increasing size and current were in operation based on the “Pinch Effect” where a large current compresses and heats the plasma to fusion temperatures. The massive ZETA [Zero Energy Thermonuclear Assembly] began operating in 1957, and while it produced many neutrons, instabilities limited the discharge to milliseconds*.

In 1968, the Soviet Union, briefed to the rest of the world on The ToKaMak [Russian acronym] which featured a toroidal current in the plasma [secondary of a

transformer] with instabilities controlled by a strong toroidal magnetic field -- resulting in much improved plasma confinement*. In 1971 Scientific American, "Recent advances in the performance of several experimental plasma containers have brought the fusion-power option very close to the "break even" level of scientific feasibility"* By 1980, dozens of Tokamaks were operating in many university and government labs around the world*

So, why are we still trying to deliver Controlled Fusion Power, some 70 years after the first demonstration of uncontrolled fusion on earth, and first laboratory experiments? Recent involving both laser inertial confinement, and tokamak based magnetic fusion, have reinitiated Eddington's challenge of delivering a "well-nigh inexhaustible" source of energy? ... "and use it for his service."

We might look at fission energy onto the grid. In 1942 Enrico Fermi's small team demonstrated controlled sustained nuclear fission with Chicago Pile #1, releasing about 3W of heat. Within a few years large Plutonium production reactors at Hanford Washington yielded a few kilograms for the "Gadget Test" device at Alamogordo, NM in the Summer of 1944 [see the blockbuster movie Oppenheimer for the color commentary]. In the 1950's a reactor powered the Nuclear Submarine Nautilus. Before Twenty years had passed, several power reactors of different designs were connected to the grid*.

Today – we seem to really be on the threshold of fusion power on the grid. In December 2022, the National Ignition Facility at Lawrence Livermore National Laboratory

"achieved its eponymous goal of – ignition – " $Q>1$ " -- more fusion energy out in the form of neutrons [3+ MJ] than the 2. MJ of energy used to compress the fuel.* DOE Secretary Jennifer M. Granholm said, "one of the most impressive scientific feats of the 21st century." On 21 December 2021, the Joint European Torus [Culham near Oxford, UK] Pulse #99971 achieved total fusion energy of 59 MJ—more than doubling the 1997 record. It generated 10 MW of fusion power, for 5 seconds. The late ITER Director-General Bernard Bigot said, "A sustained pulse of deuterium-tritium fusion at this power level—nearly industrial scale—delivers a resounding confirmation to all of those involved in the global fusion quest." At Devens, Mass., on February 10, 2023, MIT Plasma Science and Fusion Center spin-off, Commonwealth Fusion Systems (CFS) officially dedicated its campus. CEO Bob Mumgaard, "The opening of this campus marks an important moment as we continue to accelerate towards commercially, globally deployable fusion energy... and [this] will be the place where fusion science becomes fusion energy." Congresswoman Lori Trahan [co-chair House Fusion Energy Caucus] said, "From the American Revolution to our Industrial Revolution, Massachusetts has always led the way... Commonwealth Fusion's work to get us closer to unlocking low cost, carbon free fusion energy is groundbreaking... the Commonwealth is ready to lead once again."

So how do these recent developments lead to realizing Eddington's "well-nigh inexhaustible source of energy? ... and use it for his service." What needs to be done? Can we as the IEEE Boston Section foster and accelerate achieving Bob Mumgaard's, "fusion science becomes fusion energy." "Quo Vadis" IEEE Boston and Fusion?

IEEE Boston Section Social Media Links:

Twitter: <https://twitter.com/ieeeboston>

Facebook: <https://www.facebook.com/IEEEBoston>

YouTube: <https://www.youtube.com/user/IEEEBostonSection>

LinkedIn: <https://www.linkedin.com/groups/IEEE-Boston-Section-3763694/about>

Call for Articles

Now that the Reflector is all electronic, we are expanding the content of the publication. One of the new features we will be adding are technical, professional development, and general interest articles to our members and the local technology community. These will supplement the existing material already in our publication.

Technical submissions should be of reasonable technical depth and include graphics and, if needed, any supporting files. The length is flexible; however, a four to five page limit should be used as a guide. An appropriate guide may be a technical paper in a conference proceeding rather than one in an IEEE journal or transaction.

Professional development or general interest articles should have broad applicability to the engineering community and should not explicitly promote services for which a fee or payment is required.

A maximum length of two to three pages would be best.

To ensure quality, technical submissions will be reviewed by the appropriate technical area(s). Professional/interest articles will be reviewed by the Publications Committee for suitability. The author will be notified of the reviewers' decision.

The Reflector is published the first of each month. The target submission deadline for the articles should be five weeks before the issue date (e.g., June 1st issue date; article submission is April 27). This will allow sufficient time for a thorough review and notification to the author.

We are excited about this new feature and hope you are eager to participate!

Submissions should be sent to:
ieeebostonsection@gmail.com

Call for Course Speakers/Organizers

IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity. The IEEE Boston Section, its dedicated volunteers, and over 8,500 members are committed to fulfilling this core purpose to the local technology community through chapter meetings, conferences, continuing education short courses, and professional and educational activities.

Twice each year a committee of local IEEE volunteers meet to consider course topics for its continuing education program. This committee is comprised of practicing engineers in various technical disciplines. In an effort to expand these course topics for our members and the local technical community at large, the committee is publicizing this CALL FOR COURSE SPEAKERS AND ORGANIZERS.

The Boston Section is one of the largest and most technically diverse sections of the IEEE. We have over 20 active chapters and affinity groups. If you have an expertise that you feel might be of

interest to our members, please submit that to our online course proposal form on the section's website (www.ieeeboston.org) and click on the course proposal link (direct course proposal form link is

<http://ieeeboston.org/course-proposals/>. Alternatively, you may contact the IEEE Boston Section office at ieeebostonsection@gmail.com or 781 245 5405.

- **Honoraria can be considered for course lecturers**
- Applications oriented, practical focused courses are best (all courses should help attendees expand their knowledge based and help them do their job better after completing a course)
- Courses should be no more than 2 full days, or 18 hours for a multi-evening course
- Your course will be publicized to over 10,000 local engineers
- You will be providing a valuable service to your profession
- Previous lecturers include: Dr. Eli Brookner, Dr. Steven Best, Colin Brench, to name a few.

Consumer Technology Society Call for Volunteers!

We are currently looking for volunteers who would be interested in pushing forward the mission of the Consumer Technology (CT-S), Boston Chapter. The chapter is looking for volunteers to help organize chapter meetings and help meet the needs of the local CT-S member needs.

The Boston Section is organizing chapters into groups of similar technical interest areas to pool their resources for easier and better chapter collaboration in planning the chapter events.

If you have interest in volunteering for a chapter leadership position or are interested in learning more about what these volunteer positions may entail, please send an email to Karen Safina in the IEEE Boston Section office at, ieeebostonsection@gmail.com

Aakash Deliwala, Chair, IEEE Boston Consumer Technology Chapter

Engineering in Medicine & Biology Society Call for Volunteers!

We are currently looking for volunteers who would be interested in pushing forward the mission of the Engineering in Medicine & Biology Society (EMBS), Boston Chapter. The EMBS - Boston Chapter was recently approved in July 2021, and we're looking to make a significant impact in the area of Biomedicine, Bioengineering, and Biotechnology in the region. The chapter is looking for volunteers to help organize chapter meetings and help meet the needs of the local EMBS members.

The Boston Section is organizing chapters into groups of similar technical interest areas to pool their resources for easier and better chapter collaboration in planning the chapter events.

If you have interest in volunteering for a chapter leadership position or are interested in learning more about what these volunteer positions may entail, please send an email to Karen Safina in the IEEE Boston Section office at, ieeebostonsection@gmail.com.

Aseem Singh, Marie Tupaj, Co-Chairs, Boston EMBS Chapter

A pair of hands, palms up, holding a glowing, translucent hexagonal grid. Inside the grid are several out-of-focus, warm-toned bokeh lights. The background is dark, and the overall aesthetic is futuristic and technological.

What + If = IEEE

420,000+ members in 160 countries.
Embrace the largest, global, technical community.

People Driving Technological Innovation.

iee.org/membership

#IEEEmember



KNOWLEDGE

COMMUNITY

PROFESSIONAL DEVELOPMENT

CAREER ADVANCEMENT

IEEE Boston Section Online Courses:

(Students have 180 day access to all online, self-paced courses)

Electronic Reliability Tutorial Series

Full course description and registration at ,
<http://ieeeboston.org/electronic-reliability/>

Introduction to Embedded Linux Part I

Full course description and registration at ,
<http://ieeeboston.org/introduction-to-embedded-linux-part-i-el201-online-course/>

Embedded Linux Optimization - Tools and Techniques

Full course description and registration at ,
<http://ieeeboston.org/embedded-linux-optimization-tools-techniques-line-course/>

Embedded Linux Board Support Packages and Device Drivers

Full course description and registration at ,
<http://ieeeboston.org/embedded-linux-bsps-device-drivers-line-course/>

Software Development for Medical Device Manufacturers

Full course description and registration at ,
<http://ieeeboston.org/software-development-medical-device-manufacturers-line-course/>

Fundamental Mathematics Concepts Relating to Electromagnetics

Full course description and registration at ,
<http://ieeeboston.org/fundamental-mathematics-concepts-relating-electromagnetics-line-course/>

Reliability Engineering for the Business World

Full course description and registration at ,
<http://ieeeboston.org/reliability-engineering-business-world-line-course/>

Design Thinking for Today's Technical Work

<http://ieeeboston.org/design-thinking-technical-work-line-course/>

Fundamentals of Real-Time Operating Systems

<http://ieeeboston.org/fundamentals-of-real-time-operating-systems-rt201-on-line-course/>

IEEE International Symposium on Phased Array Systems and Technology

15 - 18 October 2024

Hynes Convention Center, Boston, Massachusetts, USA

www.ieee-array.org



Gold Sponsors



About the Symposium

Phased array systems continue to be a rapidly evolving technology with steady advances motivated by the challenges presented to modern military and commercial applications. This symposium will present the most recent advances in phased array technology and offer a unique opportunity for members of the international community to interact with colleagues in the field of phased array systems and technology.

The committee is thrilled to announce two major changes to the symposium to better reflect the interest and pace of technology development: (1) moving to the larger [Hynes Convention Center](https://www.hynesconventioncenter.com/) in the Back-Bay neighborhood of Boston; and (2) increasing the symposium frequency to a two-year cadence.

Be a Symposium Sponsor or Exhibitor

For sponsorship and exhibit opportunities please reach out to Mark McClure and Marc Angelucci at: sponsorships@ieee-array.org.

Suggested Topics

- 5G Arrays
- Array Design
- Array Measurements
- Array Signal Processing
- Automotive Arrays
- Beamforming & Calibration
- Digital Array Architectures
- Dual Polarized Arrays
- Low-Cost Commercial Arrays
- MIMO Arrays
- Medical Applications
- Metamaterial Phased Arrays
- mmWave and Terahertz
- T/R Modules
- Low Frequency Arrays
- SATCOM Arrays
- Weather Arrays
- Wideband Arrays

Paper Template and Submission Procedures

Template and submission procedures are available at:

<https://ieee-array.org/paper-submission>

Important Dates

- Full paper submission (2-8 pages including figures): 13 May 2024
- Author notification: 22 July 2024
- Author registration deadline: 01 Sept 2024

We are looking forward to seeing you at this next gathering.

Committee

Symposium Chairs

Sean Duffy (C), MIT LL
Wajih Elsallal (VC), MITRE

Technical Program Chairs

David Mooradd (C), MIT LL
Glenn Hopkins (VC), GTRI

Special Sessions Chairs

Matt Facchine, NGC
Kenneth E. Kolodziej, MIT LL

Plenary Session Chair

Will Moulder, MIT LL
William Weedon, Applied Radar

Student Program

Matilda Livadaru, Raytheon Tech
Justin Kasemodel, Raytheon Tech

Tutorials

Cara Kataria, MIT LL
Frank Vliet, TNO

Sponsorship and Exhibits

Marc Angelucci, LMC
Mark McClure, STR

Digital Platforms Chairs

Pierre Dufile, Raytheon Tech
Jacob Houck, GTRI
Mark Fosberry, MITRE
Shireen Warnock, MIT LL

Publications/Publicity

Philip Zurek, MIT LL
Jack Logan, NRL
Elizabeth Kowalski, MIT LL

Poster Sessions Chair

Honglei Chen, MathWorks

Advisors

Daniel Culkin, NGC
Alan J. Fenn, MIT LL
Jeffery S. Herd, MIT LL
Bradley Perry, MIT LL

Arrangements/Administration

Robert Alongi, IEEE Boston
Kathleen Ballos, Ballos Assoc.

Silver Sponsors



Technical Co-Sponsors



Media Sponsor



IEEE Video Series

A collaborative discussion panel featuring esteemed members from the Institute of Electrical and Electronics Engineers has convened in 2021 to produce educational video presentations that embrace IEEE's mission of advancing technology for humanity.

Among the programs they've produced include "Electric Vehicles: Fun Saving Our Planet", "Greener Power For More Electric Vehicles", "Overcoming Nuclear Fears To Achieve Net Zero CO2 By 2050" and "Achieving a Net Zero Carbon Future", "Green Energy's Economic Progress", and "Net-Zero CO2 with Nuclear, Hydrogen and Geothermal". Projects currently in production include the expansive topic of futurology, with a focus on increasing the efficiency and transformation of aging electrical power generating stations and infrastructure to accommodate nuclear power; reviewing the viability of alternative energy (such as geothermal, wind and solar); and focusing on 'cleaner' fossil fuels that are more environmentally-friendly to slow the rate of climate change.

These shows are produced and directed by Lennart E. Long, IEEE Senior Life Member from the Executive Committee and Past Chair of the Boston Section; Dr. Paul H Carr, BS, MS, MIT; PhD Brandeis U, IEEE Life Fellow; Dr. Ted Kochanski, SB (MIT), Ph.D (U.Texas, Austin), IEEE Global Education for Microelectronic Systems and former Boston Section Chair; and Dr. Ken Laker, B.E. (Manhattan College), M.S. and Ph.D. (New York University), IEEE Life Fellow and past President of IEEE.

The panel is moderated by five-time Boston/New England Emmy Award-winner and television personality and star of "The Folklorist," John Horrigan. These video programs with presentations and discussions can be accessed at the IEEE Boston Section video portal at <https://vimeo.com/user18608275>.

We are looking for any IEEE members that would like to appear on the program in the role of presenter or discussion expert. Simply reach out to Robert Alongi at the Boston Section at, ieebostonsection@gmail.com.

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ieebostonsection@gmail.com

IEEE Boston Section Volunteers Wanted!

Are you passionate about technology and eager to contribute to the advancement of your field? The IEEE Boston Section is excited to announce a call for volunteers to join our dynamic team of professionals and enthusiasts. By becoming a volunteer, you'll have the opportunity to collaborate with like-minded individuals, develop new skills, and make a meaningful impact on the local technology community.

About IEEE Boston Section:

The IEEE Boston Section is a thriving community of engineers, researchers, students, and industry professionals dedicated to promoting technological innovation and knowledge sharing. Our section hosts a variety of events, workshops, seminars, and conferences throughout the year, providing members with opportunities to learn, network, and stay updated on the latest developments in their fields.

Volunteer Opportunities:

We are currently seeking volunteers to help on the following committees:

The Fellow and Awards Committee - activities include recommending qualified members of the Section for advancement to Fellow grade and for receipt of the various IEEE (IEEE/Region/MGA/Section) awards. Identifying and building a database of the various IEEE awards available for nomination and searching out qualified candidates, for preparing the necessary written recommendations, and for assembling all required supporting documentation and submit its recommendations directly to the appropriate IEEE body.

Time Commitment: Meets 4 times a year for 1 – 2 hours per meeting (virtual or in person)

Local Conferences Committee - activities include identifying timely topical areas for conference development. Identify champions of these conferences to run the identified conference organizing committees. The section local conference committee is not charged with organizing and executing individual conferences.

Time Commitment: Meets 4 times per year 1 – 2 hours per meeting (virtual or in person)

Professional Development & Education Committee - activities include identifying topics, speakers, and/or organizers for appropriate technical lecture series or seminars. The subject matter should be timely, of interest to a large segment of the membership, and well organized with regard to speakers and written subject matter.

Time Commitment: meets 4 times per year, 1 – 2 hours per meeting (virtual or in person)

The Membership Development Committee - activities include actively promoting membership in the IEEE and shall encourage members to advance to the highest grade of membership for which they are qualified. To these ends this committee shall include wide representation within the Section territory, shall maintain lists of

prospects and members qualified for advancement, and shall provide information and assistance to preparing applications.

Time Commitment: meets 4 times per year, 1 – 2 hours per meeting (virtual or in person)

Student Activities Committee - activities include attracting a broad and diverse group of undergraduate and graduate students to IEEE and to engage them in activities that promote their own professional development as well as the ongoing growth of IEEE. The Student Activities Committee shall include among its members the IEEE Counselors at the universities, colleges, and technical institutes that lie within the Section territory. It shall be responsible for liaison with the Student Branches at these institutions and advise the Executive Committee on all other matters affecting the Student Members of the Section.

Time Commitment: meets 4 times per year, 1 – 2 hours per meeting (virtual or in person)

Young Professionals Affinity Group - activities include organizing programs, and initiatives aimed to address the needs of early-career professionals pursuing technology-related careers in engineering, business, management, marketing, and law. This committee is committed to helping young professionals evaluate their career goals, polish their professional image, and create the building blocks of a lifelong and diverse professional network.

Time Commitment: meets 4 times per year, 1 – 2 hours per meeting (virtual or in person)

Benefits of Volunteering:

Volunteering with IEEE Boston Section offers numerous benefits, including:

- Networking opportunities with professionals in your field.
 - Skill development and enhancement through hands-on experience.
 - Contribution to the local technology community and its growth.
- Access to cutting-edge information and discussions.

How to Get Involved:

If you're enthusiastic about technology and want to make a difference, we invite you to join us as a volunteer. To express your interest and learn more about specific roles, please visit our website and fill out the volunteer application form. Our team will get in touch with you to discuss opportunities that align with your interests and skills.

Thank you for considering this opportunity to contribute to the IEEE Boston Section. Your dedication and passion are what drive the success of our community and its impact on the world of technology.

Volunteer Here!

<https://ieeeboston.org/volunteer/>



Business Manager

The Institute of Electrical and Electronics Engineers, Inc. (IEEE) is looking for a Business Manager for its Boston area operations This person should have experience in overseeing business operations, finance, marketing, social media

Key Responsibilities:

- Assists the IEEE Boston Section in the development of a diverse portfolio of programs and services that drives member engagement
- Facilitates the research, identification, and planning of sources of revenue and funding, such as courses and conferences
- Manages the financial affairs of the Boston Section
- Oversees the planning and implementation of the marketing of the Boston Section and its events, including a social media presence.
- Acts as Managing Editor of the Boston Section newsletter.

Education

- Bachelor's degree or equivalent experience Consideration may be given to non-degreed individuals whose experience and credentials are considered equivalent.

Work Experience

- 4-7 years relevant experience in management roles, with responsibility for profit-loss
- Experience drafting and managing budgets, and cash flow analysis, including Financial Management and Annual Reporting
- Experience in not-for-profit organization management preferred

For More Details and to Apply

https://ieee.taleo.net/careersection/2/jobdetail.ftl?job=230317&tz=G-MT-05%3A00&tzname=America%2FNew_York

Computer Society and GBC/ACM, 7:00PM, Thursday, February 1

DBOS: A Database-oriented Operating System

Speaker: Michael Stonebraker, MIT

Location: MIT Room 32-G449 (Kiva) and online via Zoom

Please register in advance for this seminar even if you plan to attend in person at
https://acm-org.zoom.us/webinar/register/1717017075074/WN_RKdRzZZdRPuT0LqrY14JLw

After registering, you will receive a confirmation email containing information about joining the webinar. Indicate on the registration form if you plan to attend in person. This will help us determine whether the room is close to reaching capacity. We may make some auxiliary material such as slides and access to the recording available after the seminar to people who have registered.

For the last three years, a team of us at MIT, Stanford, CMU, Google and VMware have built a new operating system stack, based on a high-performance distributed DBMS. In other words, all OS state (files, messages, scheduling information, etc.) is stored in the DBMS and all OS services are written in SQL plus stored procedures. At the present time, we have a secured venture capital funding and are about to release a commercial open source version. In this talk, I report on aspects of our system, including:

Performance: DBOS is competitive with the state of the art concerning file system performance, message performance and scheduling performance. All of these are implemented in SQL.

Provenance: Because all OS state is in DBMS tables, DBOS change capture moves all state to a warehouse DBMS (currently Vertica or Redshift) with a runtime overhead of about 5%. In this case, security queries (e.g. looking for outliers) supporting the “right to be forgotten” in GDPR-style systems and other provenance operations can be coded in SQL. Experiments with a current security product show that DBOS can both capture provenance data and query it with higher performance.

Serverless environment: We have written a Java serverless environment on top of DBOS. It is an order of magnitude faster than current systems (AWS Lambda, Open Whisk) because it co-locates computation and data whenever possible. Also, provenance facilitates a novel time-travel debugger.

Early enterprise usage: I will report on early DBOS us-

age in enterprise environments at three large enterprises.

Commercialization changes to DBOS: These include moving to TypeScript and open source DBMSs.



Dr. Stonebraker has been a pioneer of database research and technology for more than forty years. He was the main architect of the INGRES relational DBMS, and the object-relational DBMS, POSTGRES. These prototypes were developed at the University of California at Berkeley where Stonebraker was a Professor of Computer Science for twenty-five years. More recently at M.I.T. he was the co-architect of the C-Store column-oriented DBMS, the H-Store transaction processing engine, the Data Tamer data integration system, the SciDB array processing engine, the Kyrix visualization system and the operating system DBOS. He is the founder of ten venture-capital backed startups which have commercialized his prototypes.

Professor Stonebraker is the author of scores of research papers on database technology, operating systems and the architecture of system software services. He was awarded the ACM System Software Award in 1992, for his work on INGRES. Additionally, he was awarded the first annual Innovation award by the ACM SIGMOD special interest group in 1994 and was elected to the National Academy of Engineering in 1997. He was awarded the IEEE John Von Neumann award in 2005, and the ACM Turing Award in 2014. Presently he is an Adjunct Professor of Computer Science at M.I.T., where he is working on a variety of future-generation data-oriented projects.

This joint meeting of the Boston Chapter of the IEEE Computer Society and GBC/ACM will be hybrid (in person and online), part of getting back to normal after the COVID-19 lockdown.

Up-to-date information about this and other talks is available online at <https://ewh.ieee.org/r1/boston/computer/>. You can sign up to receive updated status information about this talk and informational emails about future talks at <https://mailman.mit.edu/mailman/listinfo/ieee-cs>, our self-administered mailing list.

Photonics Society and co-sponsoring Life Members – 6:00PM, Thursday, February 1

Historical Evolution and State-of-the-Art Fiber-Optic Communication Systems

Speaker: Dr. René-Jean Essiambre

Location: MIT Lincoln Laboratory, 3 Forbes Rd., Lexington MA

This presentation will first provide a historical overview of the physical media used in wired communication, from electrical wires to waveguides. A special attention will be given to the hollow metallic waveguide, an area pioneered simultaneously by MIT and Bell Labs. It will be followed by a brief survey of innovative optical transmission lines that were proposed prior to the discovery of low-loss optical fibers.

The next portion of the talk will focus on the ultimate limits of optical fibers to carry information in optical networks due to nonlinear response of the optical fibers. The role and impact of different electronic and optical technologies to improve optical network capacity will be laid out. This includes digital coherent detection, digital signal processing and optical amplification. The role and potential of solid-core optical fibers allowing multiple spatial modes in each fiber strand as well as hollow-core fibers will be discussed.

Finally, the impact of quantum technologies on optical communication will be touched upon with an experimental demonstration of detection power efficiency above ten information bits per received photon.

René-Jean Essiambre joined Bell Labs in 1997 and is currently based at the Murray Hill laboratory in New Providence, New Jersey, USA. Dr. Essiambre worked on topics such as fiber lasers, nonlinear fiber optics, advanced modulation formats, space-division multiplexing, information theory, and high-photon-efficiency systems. He participated in the design of commercial fiber-optic communication systems where several of his inventions were implemented. He has given over 150 invited talks and helped prepare and delivered the 2018 Physics Nobel Prize Lecture on behalf of Arthur Ashkin. He served on or chaired many conference committees, including OFC, ECOC, CLEO, and IPC. He received the 2005 Engineering Excellence Award from OPTICA and is a fellow of the IEEE, OPTICA, IAS-TUM, and Bell Labs. He was President of the IEEE Photonics Society (2022-2023) and is currently the Past-President (2024-2025).

Registration:

<https://events.vtools.ieee.org/event/register/401421>

IEEE Boston Section Social Media Links:

Twitter: <https://twitter.com/ieeeboston>

Facebook: <https://www.facebook.com/IEEEBoston>

YouTube: <https://www.youtube.com/user/IEEEBostonSection>

LinkedIn: <https://www.linkedin.com/groups/IEEE-Boston-Section-3763694/about>

Boston/Providence/New Hampshire Reliability Chapter – 11:00AM, Wednesday, February 7

Analyzing Time-to-Event Data: A Comparison Between Reliability and Survival Methods

Speaker: Jian Cao of JMP

Location: This Webinar is to be delivered virtually.

Please visit <https://r1.ieee.org/boston-rl/>



Chapter Reliability analysis and survival analysis both deal with the time-to-event data, which is often censored and highly skewed. Medical researchers try to predict the survival probabilities, survival times and other important characteristics. Therefore, it is not surprising to see many of the reliability analysis tools being used in clinical trials and epidemic research. After all, survival is the complementary event to failure.

In this talk I will focus on the parallels and distinctions between the two statistical methods through some real-life examples. I will also demonstrate modern predictive modeling tools that are useful to reliability engineers.

Location: This Webinar is to be delivered virtually.

At registration, you must provide a valid e-mail address to receive the Webinar Session link approximately 15 hours before the event. The link will only be sent to the e-mail address entered with your registration. Please

double-check for spelling errors. If you haven't received the e-mail as scheduled, please check your spam folder and alternate e-mail accounts before contacting the host.

Registration Starts 21 January 2024 12:00 AM Ends 06 February 2024 05:30 PM

All times are (UTC-05:00) Eastern Time (US & Canada)
No Admission Charge

Agenda

11:00 AM: Technical Presentation

11:45 AM: Questions and Answers

12:00 PM: Adjournment

The meeting is open to all. You do not need to belong to the IEEE to attend this event; however, we welcome your consideration of IEEE membership as a career enhancing technical affiliation. There is no cost to register or attend, but registration is required.

Registration:

<https://events.vtools.ieee.org/m/401062>

IEEE Boston Section Social Media Links:

Twitter: <https://twitter.com/ieeeboston>

Facebook: <https://www.facebook.com/IEEEBoston>

YouTube: <https://www.youtube.com/user/IEEEBostonSection>

LinkedIn: <https://www.linkedin.com/groups/IEEE-Boston-Section-3763694/about>

Aerospace and Electronic Systems, and IEEE Robotics and Automation Societies – 6:00PM, Tuesday, February 13

Research Advances in UAS and Advanced Air Mobility: Detect and Avoid and Path Planning for High Density Airspace

Distinguished Lecture - Giancarmine Fasano, University of Naples

Location: QinetiQ US – 358 Second Avenue, Waltham, MA 02451



Giancarmine Fasano is Associate Professor at the University of Naples “Federico II”, where he teaches courses in “Unmanned Aircraft Systems”, “Space Flight Dynamics”, and “Design of Autonomous Aircraft”, as part of the M.S. Programs in Aerospace Engineering and Autonomous Vehicles Engineering. He also holds courses (UAS and Mini/micro-UAS Lab) at the Italian Air Force Academy. His research activities in the field of aeronautics are focused on UAS, and in particular on sense and avoid, cooperative multi-drone systems, path planning and navigation with recent emphasis on Advanced Air Mobility scenarios. In the space field he is mainly interested in distributed space systems and proximity operations, with emphasis on relative motion design/control and relative navigation, and in space domain awareness.

He is Vice-Chair of the Avionics Systems Panel (ASP) of the IEEE Aerospace and Electronic Systems Society, Senior Editor of the IEEE Transactions on Aerospace and Electronic Systems for the Avionics area, Associate Editor of the IEEE AESS Magazine for the UAS area of specialty, and IEEE Senior Member. Since 2019, he has been Member of the Organizing Committee and Tutorial Instructor at the IEEE/AIAA Digital Avionics Systems Conference. He is Member of the AIAA Sensor Systems and Information Fusion Technical Committee and AIAA Senior Member, and he has also been Member of the IAA (International Academy of Astronautics) Committee on Small Satellites. He has co-authored about 200 publications and five book chapters.

In the recent past, important efforts have been devoted to the safe integration of Unmanned Aircraft Systems (UAS) in all classes of airspace, a key-prerequisite to unleash their full potential for civilian operations. Closely linked with these developments, advanced air mobility (AAM) has appeared as a new and disruptive dimension for aviation, potentially enabling mobility of goods and people at a different scale compared with current operations. This exciting evolution is reshaping the future of aviation, but it also challenges traditional paradigms in the field of avionics, and requires advances both from a technological and a regulatory perspective.

This lecture addresses gaps and recent research advances in this framework, focusing within a unified perspective on detect and avoid (DAA) and path planning / airspace management. DAA has represented one of the main roadblocks to the integration of UAS operations. The lecture will first outline architectures, technologies, and algorithms for DAA. Then, it will discuss recent trends and progress in DAA and more in general in low altitude airspace surveillance. Concerning path planning, the focus will be set on highly autonomous low-altitude flight operations in dense urban environments, which emphasize the links between airspace structure and management, and the requirements on communications navigation and surveillance (CNS) technologies. The lecture will address recent multi-objective navigation-aware strategic and tactical planning approaches which can be used as workhorses for traffic deconfliction at infrastructure and vehicle level.

Registration is required:

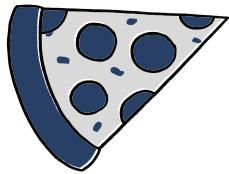
<https://events.vtools.ieee.org/m/401873>



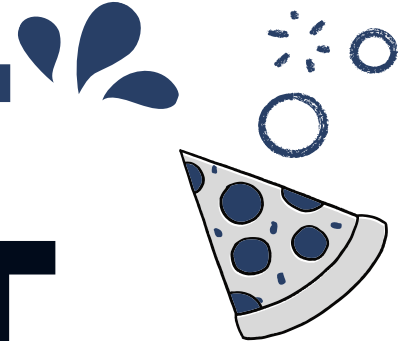
IEEE Power Electronics Society Boston Chapter



sponsored by  presents



MEET & GREET



When: February 22, 2024 | 5:30-7:30PM

Where: Shillman Hall 335,
Northeastern University
115 Forsyth Ave, Boston, MA, 02115

Register here: <http://tinyurl.com/PELSboston>

Agenda (Online & In-person)

In-person and online:

- Opening remarks by **Prof. Brad Lehman**, NEU, IEEE PELS President - 5 min
- Chapter introduction by **Dr. Arshiah Mirza**, Shell Techworks, IEEE PELS Boston Chapter Chair - 5 min
- Introduction by **Plexim** - 5 min
- Technical talk on 'Future trends in Power electronics', by **Prof. Brad Lehman** - 30 min
- Trivia (online game) - 20 min

In-person only:

- Meet and Greet - Pizza provided - 1 hr



Can't make it in-person? Join our virtual meeting instead!!



<https://northeastern.zoom.us/j/99547252619>

Reach out to arshiah.mirza@ieee.org for any questions!

Introduction to Neural Networks and Deep Learning (Part I)

Web-based Course with live Instructor!

Times & Dates: 9AM - 12:30PM ET, Saturday, March 16, 2024

Speaker: CL Kim

Course Format: Live Webinar, 3.5 hours of instruction!

Series Overview: Neural networks and deep learning currently provides the best solutions to many problems in image recognition, speech recognition, and natural language processing.”

Reference book: “Neural Networks and Deep Learning” by Michael Nielsen, <http://neuralnetworksanddeeplearning.com/>

This Part 1 and the planned Part 2, (to be confirmed) series of courses will teach many of the core concepts behind neural networks and deep learning.

More from the book introduction: We’ll learn the core principles behind neural networks and deep learning by attacking a concrete problem: the problem of teaching a computer to recognize handwritten digits. ...it can be solved pretty well using a simple neural network, with just a few tens of lines of code, and no special libraries.”

“But you don’t need to be a professional programmer.”

The code provided is in Python, which even if you don’t program in Python, should be easy to understand with just a little effort.

Benefits of attending the series:

- * Learn the core principles behind neural networks and deep learning.
- * See a simple Python program that solves a concrete problem: teaching a computer to recognize a handwritten digit.
- * Improve the result through incorporating more and more core ideas about neural networks and deep learning.
- * Understand the theory, with worked-out proofs of fundamental equations of backpropagation for those interested.
- * Run straightforward Python demo code example.

The demo Python program (updated from version provided in the book) can be downloaded from the speaker’s GitHub account. The demo program is run in a Docker container that runs on your Mac, Windows, or Linux personal computer; we plan to provide instructions on doing that in advance of the class.

(That would be one good reason to register early if you plan to attend, in order that you can receive the straightforward instructions and leave yourself with plenty of time to prepare the Git and Docker software that are widely used among software professionals.)

Course Background and Content: This is a live instructor-led introductory course on Neural Networks and Deep Learning. It is planned to be a two-part series of courses. The first course is complete by itself and covers a feedforward neural network (but not convolutional neural network in Part 1). It will be a pre-requisite for the planned Part 2 second course. The class material is mostly from the highly-regarded and free online book “Neural Networks and Deep Learning” by Michael Nielsen, plus additional material such as some proofs of fundamental equations not provided in the book.

Outline:

Feedforward Neural Networks.

- * Simple (Python) Network to classify a handwritten digit
- * Learning with Stochastic Gradient Descent
- * How the backpropagation algorithm works
- * Improving the way neural networks learn:
 - ** Cross-entropy cost function
 - ** Softmax activation function and log-likelihood cost function
 - ** Rectified Linear Unit
 - ** Overfitting and Regularization:
 - *** L2 regularization
 - *** Dropout
 - *** Artificially expanding data set

Pre-requisites: There is some heavier mathematics in learning the four fundamental equations behind backpropagation, so a basic familiarity with multivariable calculus and matrix algebra is expected, but nothing advanced is required. (The backpropagation equations can be also just accepted without bothering with the proofs since the provided Python code for the simple network just make use of the equations.) Basic familiarity with Python or similar computer language.

Speaker Background: CL Kim works in Software Engineering at CarGurus, Inc. He has graduate degrees in Business Administration and in Computer and Information Science from the University of Pennsylvania. He had previously taught for a few years the well-rated IEEE Boston Section class on introduction to the Android platform and API.

**Decision (Run/Cancel) Date for this Course is
Friday, March 8, 2024**

Payment	on/by March 1	After March 1
IEEE Members	\$95	\$110
Non-members	\$115	\$130

https://ieeeboston.org/event/neuralnetworks/?instance_id=3569

Call for Course Speakers/Organizers

IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity. The IEEE Boston Section, its dedicated volunteers, and over 8,500 members are committed to fulfilling this core purpose to the local technology community through chapter meetings, conferences, continuing education short courses, and professional and educational activities.

Twice each year a committee of local IEEE volunteers meet to consider course topics for its continuing education program. This committee is comprised of practicing engineers in various technical disciplines. In an effort to expand these course topics for our members and the local technical community at large, the committee is publicizing this CALL FOR COURSE SPEAKERS AND ORGANIZERS.

The Boston Section is one of the largest and most technically diverse sections of the IEEE. We have over 20 active chapters and affinity groups. If you have an expertise that you feel might be of

interest to our members, please submit that to our online course proposal form on the section's website (www.ieeeboston.org) and click on the course proposal link (direct course proposal form link is

<http://ieeeboston.org/course-proposals/>. Alternatively, you may contact the IEEE Boston Section office at ieeebostonsection@gmail.com or 781 245 5405.

- **Honoraria can be considered for course lecturers**
- Applications oriented, practical focused courses are best (all courses should help attendees expand their knowledge based and help them do their job better after completing a course)
- Courses should be no more than 2 full days, or 18 hours for a multi-evening course
- Your course will be publicized to over 10,000 local engineers
- You will be providing a valuable service to your profession
- Previous lecturers include: Dr. Eli Brookner, Dr. Steven Best, Colin Brench, to name a few.

Digital Signal Processing (DSP) for Software Radio

Dates & Times: Course Kick-off/Orientation, 6 - 6:30PM ET, Thursday, June 13
 Live Workshops: 6:00 - 7:30PM ET; Thursdays, June 20, 27, July 11, 18, 25
 First Video Release, Thursday, June 13, 2024, additional videos released weekly in advance of that week's live session!

Speaker: Dan Boschen
Location: Zoom

Attendees will have access to the recorded session and exercises for two months (until August 20, 2024) after the last live session ends!

This is a hands-on course providing pre-recorded lectures that students can watch on their own schedule and an unlimited number of times prior to live Q&A/Workshop sessions with the instructor. Ten 1.5 hour videos released 2 per week while the course is in session will be available for up to two months after the conclusion of the course.

Course Summary This course builds on the IEEE course "DSP for Wireless Communications" also taught by Dan Boschen, further detailing digital signal processing most applicable to practical real-world problems and applications in radio communication systems. Students need not have taken the prior course if they are familiar with fundamental DSP concepts such as the Laplace and Z transform and basic digital filter design principles.

This course brings together core DSP concepts to address signal processing challenges encountered in radios and modems for modern wireless communications. Specific areas covered include carrier and timing recovery, equalization, automatic gain control, and considerations to mitigate the effects of RF and channel distortions such as multipath, phase noise and amplitude/phase offsets.

Dan builds an intuitive understanding of the underlying mathematics through the use of graphics, visual demonstrations, and real-world applications for mixed

signal (analog/digital) modern transceivers. This course is applicable to DSP algorithm development with a focus on meeting practical hardware development challenges, rather than a tutorial on implementations with DSP processors.

Now with Jupyter Notebooks! This long-running IEEE Course has been updated to include Jupyter Notebooks which incorporates graphics together with Python simulation code to provide a "take-it-with-you" interactive user experience. No knowledge of Python is required but the notebooks will provide a basic framework for proceeding with further signal processing development using that tools for those that have interest in doing so.

This course will not be teaching Python, but using it for demonstration. A more detailed course on Python itself is covered in a separate IEEE Course routinely taught by Dan titled "Python Applications for Digital Design and Signal Processing".

All set-up information for installation of all tools used will be provided prior to the start of class.

Target Audience: All engineers involved in or interested in signal processing for wireless communications. Students should have either taken the earlier course "DSP for Wireless Communications" or have been sufficiently exposed to basic signal processing concepts such as Fourier, Laplace, and Z-transforms, Digital filter (FIR/IIR) structures, and representation of complex digital and analog signals in the time and frequency do-

if you are uncertain about your background or if you would like more information on the course.

Benefits of Attending/ Goals of Course:

Attendees will gain a strong intuitive understanding of the practical and common signal processing implementations found in modern radio and modem architectures and be able to apply these concepts directly to communications system design.

Topics / Schedule:

Class 1: DSP Review, Radio Architectures, Digital Mapping, Pulse Shaping, Eye Diagrams

Class 2: ADC Receiver, CORDIC Rotator, Digital Down Converters, Numerically Controlled Oscillators

Class 3: Digital Control Loops; Output Power Control, Automatic Gain Control

Class 4: Digital Control Loops; Carrier and Timing Recovery, Sigma Delta Converters

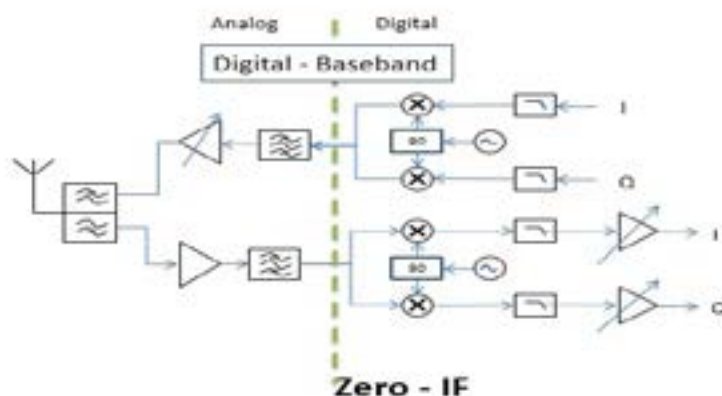
Class 5: RF Signal Impairments, Equalization and Compensation, Linear Feedback Shift Registers

Speaker's Bio:

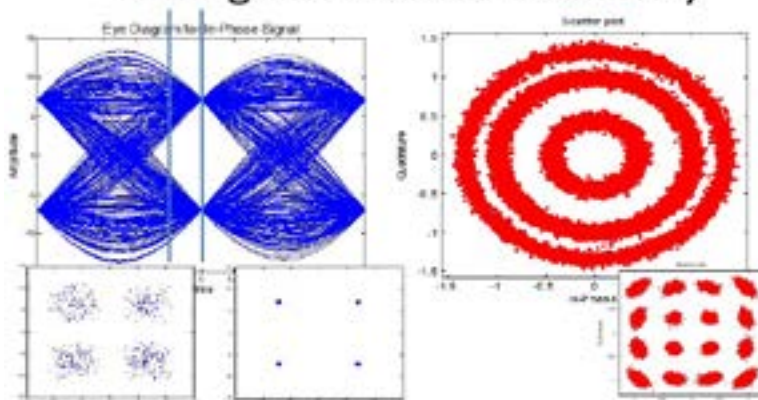
Dan Boschen has a MS in Communications and Signal Processing from Northeastern University, with over 25 years of experience in system and hardware design for radio transceivers and modems. He has held various positions at Signal Technologies, MITRE, Airvana and Hittite Microwave designing and developing transceiver hardware from baseband to antenna for wireless communications systems and has taught courses on DSP to international audiences for over 15 years. Dan is a contributor to Signal Processing Stack Exchange <https://dsp.stackexchange.com/>, and is currently at Microchip (formerly Microsemi and Symmetricom) leading design efforts for advanced frequency and time solutions.

For more background information, please view Dan's Linked-In page at: <http://www.linkedin.com/in/dan-boschen>

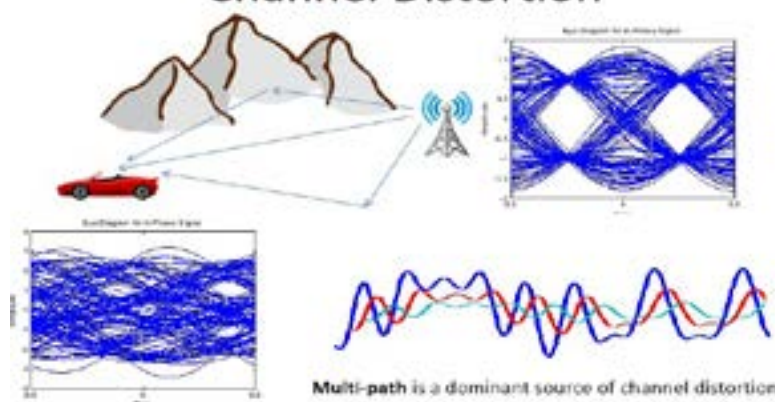
Radio Architectures



Timing and Carrier Recovery



Channel Distortion



**Decision (Run/Cancel) Date for this Course is
Thursday, June 6, 2024**

	By May 30	After May 30
IEEE Members	\$190	\$285
Non-members	\$210	\$315

https://ieeeboston.org/event/dspswradio/?instance_id=3560

Advanced Digital Design: Implementing Deep Machine Learning on FPGA

Times & Dates: Postponed until Spring. See future Reflectors for Updates
Speaker: Kendall Farnham, Dartmouth College

Hosted by

Location: MITRE Corporation, Bedford, MA



Course Overview:

Field-programmable gate arrays (FPGAs) are versatile integrated circuits that offer a flexible and reconfigurable hardware platform for implementing custom digital circuits, particularly in applications requiring specialized architectures. Unlike application-specific integrated circuits (ASICs), FPGAs can be programmed and re-programmed after manufacturing using hardware description languages (HDLs), enabling rapid prototyping and iterative design processes. FPGAs can be found in telecommunications, signal processing, aerospace, and other scenarios demanding high-performance computing, parallel processing, low-latency data processing, and real-time operations. The newest trends include integrating FPGAs with systems on chip (SoCs) for implementing low-latency machine learning (ML) and artificial intelligence.

This Advanced Digital Design course is an intensive program designed to build upon foundational concepts in digital logic design and equip students with the skills needed to implement robust high-speed ML algorithms on an FPGA. Through a combination of theoretical lectures, hands-on exercises, and practical projects, students will explore advanced FPGA topics encompassing architectural considerations, signal integrity, timing analysis, and optimization techniques to achieve reliable and efficient high-speed designs. Additionally, this course will encourage students to explore current research papers and real-world industry applications to foster a deeper appreciation for advancements in state-of-the-art FPGA design.

Target audience:

Students and professionals with a base knowledge of FPGA design looking to advance hardware design skills for developing complex customized circuits for efficient implementation of ML.

Benefits of attending:

- Valuable professional development creating skills that lead to job offers
- Reinforce and expand knowledge of VHDL and FPGA-specific design methodology.
- Develop skills for implementing high-speed, robust, reliable circuits on FPGAs.
- Gain understanding of real-world industry applications of FPGAs and SoCs.

Course Objectives:

By the end of this course, students will possess the expertise needed to tackle complex high-speed hardware design challenges using FPGAs. They will be well-prepared to contribute to cutting-edge research, industry projects, and advancements in areas such as telecommunications, data centers, embedded systems, and high-performance computing.

Prerequisites:

- Understanding of digital logic design principles and methodology (e.g., Boolean algebra, finite state machines, data path elements)
- Familiarity with VHDL programming (or Verilog)
- Experience with FPGA development boards and tools (e.g., Vivado)

Speaker Bio:

Kendall Farnham is a PhD candidate in Dr. Ryan Halter's bioimpedance lab at the Thayer School of Engineering, Dartmouth College. She has 10+ years of experience in the electrical and computer engineering (ECE) field and 5+ years of teaching and mentoring experience, having held several leadership positions within academia and industry. She received her bachelor's degree in ECE in 2014, worked in the defense industry as a software engineer for 4 years where she discovered her passion for research, and returned to

school to expand her education to include hardware design for space medicine applications. Specifically, she is interested in FPGA-based biomedical device design, currently working to develop space-compatible technologies that use impedance to monitor and detect physiological effects of space travel. Her expertise includes high-performance FPGA-based digital system design, analog circuit design, multi-modal imaging algorithms, and system integration.

Course Outline:

1. Review of Digital Logic Design and FPGA Programming

- Boolean algebra, combinational and sequential circuits, finite state machines
- FPGA, SoC, and SoM architectures and tool-chains
- VHDL programming techniques and design methodology
- Writing effective testbenches, RTL simulation in Vivado
- Introduction to ML algorithms and FPGA-specific optimization strategies

2. High-throughput Communication on FPGAs

- Pipelining and parallelism for high-speed designs
- Synchronous vs. asynchronous communication protocols (SPI, SCI, UART, LVDS, I2C, PCIe, USB, Ethernet, etc.)
- Compare hardware/software/firmware implementations of ML: throughput speeds, resource utilization, and latency
- Methods used to achieve ultra-high sampling rates ($\gg$ system clock, GS/s range)
- Utilizing advanced IP cores and IO buffers for high-speed interfaces and data storage

3. Advanced FPGA Techniques for High-speed Systems

- Clock domain crossing verification and synchronization techniques

- Resource utilization, critical path identification, and optimization strategies
- Timing constraints, static and dynamic timing analysis
- Signal integrity analysis

4. High-Speed Design Verification and Testing

- Simulation-based verification techniques, advanced debugging, and waveform analysis
- Post-layout verification and back-annotation
- Test and validation strategies for high-speed designs

- Utilizing debug cores for real-time logic analysis

5. Machine Learning on FPGAs

- Algorithm validation and verification in software
- Compare capabilities and implementation strategies of ML on FPGAs, SoCs, and SoMs
- Optimization strategies for efficient ML implementation in hardware (e.g., convolution)

6. Digital Systems in Industry

- Techniques and best practices for scalable, reusable, reliable, and robust FPGA design
- Board-level considerations for high-speed signals: PCB layout guidelines, power distribution and decoupling, transmission line theory and termination techniques
- Emerging trends for FPGA-based digital signal processing (DSP) applications

CEU/PDH are available upon request. A small fee may apply for the credits

Decision (Run/Cancel) Date for this Course is

**Payment
IEEE Members
Non-members**

Will be updated at a later date

https://ieeeboston.org/event/advanced-digital-design/?instance_id=3481

DSP for Wireless Communications

Dates & Times: Course Kick-off/Orientation, 6 - 6:30PM ET, Thursday, April 18
 Live Workshops: 6:00 - 7:30PM ET; Thursdays, April 25, May 2, 9, 16, 23
 First Video Release, Thursday, April 18, 2024 additional videos released weekly in advance of that week's live session!

Speaker: Dan Boschen
Location: Zoom

New Format Combining Live Workshops with Pre-recorded Video - This is a hands-on course providing pre-recorded lectures that students can watch **on their own schedule** and an **unlimited number of times** prior to live Q&A/Workshop sessions with the instructor. Ten 1.5 hour videos released 2 per week while the course is in session will be available for up to two months after the conclusion of the course...until July 23, 2024

Course Summary

This course is a fresh view of the fundamental and practical concepts of digital signal processing applicable to the design of mixed signal design with A/D conversion, digital filters, operations with the FFT, and multi-rate signal processing. This course will build an intuitive understanding of the underlying mathematics through the use of graphics, visual demonstrations, and applications in GPS and mixed signal (analog/digital) modern transceivers. This course is applicable to DSP algorithm development with a focus on meeting practical hardware development challenges in both the analog and digital domains, and not a tutorial on working with specific DSP processor hardware.

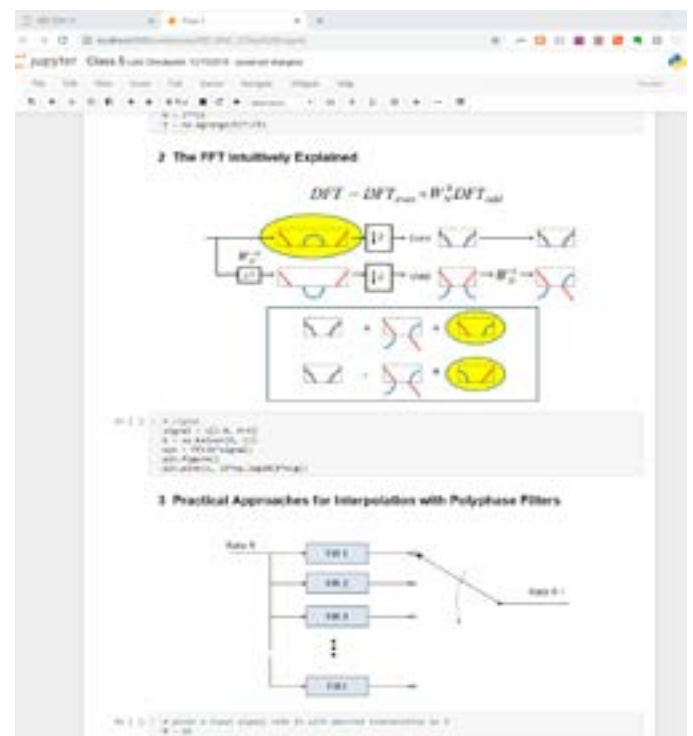
Now with Jupyter Notebooks!

This long-running IEEE Course has been updated to include Jupyter Notebooks which incorporates graphics together with Python simulation code to provide a "take-it-with-you" interactive user experience. No knowledge of Python is required but the notebooks will provide a basic framework for proceeding with further signal processing development using that tools for those that have interest in doing so.

This course will not be teaching Python, but using it for

is covered in a separate IEEE Course "Python Applications for Digital Design and Signal Processing".

Students will be encouraged but not required to load all the Python tools needed, and all set-up information for installation will be provided prior to the start of class.



Target Audience:

All engineers involved in or interested in signal processing applications. Engineers with significant experience with DSP will also appreciate this opportunity for an in-depth review of the fundamental DSP concepts from a different perspective than that given in a traditional introductory DSP course.

Benefits of Attending/ Goals of Course:

Attendees will build a stronger intuitive understanding of the fundamental signal processing concepts involved with digital filtering and mixed signal analog and digital design. With this, attendees will be able to implement more creative and efficient signal processing architectures in both the analog and digital domains. The knowledge gained from this course will have immediate practical value for any work in the signal processing field.

Topics / Schedule:

Class 1: Correlation, Fourier Transform, Laplace Transform

Class 2: Sampling and A/D Conversion, Z –transform, D/A Conversion

Class 3: IIR and FIR Digital filters, Direct Fourier Transform

Class 4: Windowing, Digital Filter Design, Fixed Point vs Floating Point

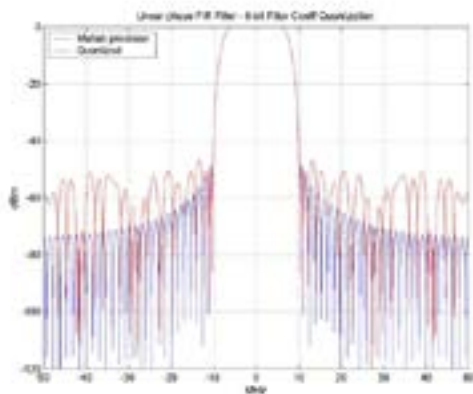
Class 5: Fast Fourier Transform, Multi-rate Signal Processing, Multi-rate Filters

Speaker's Bio:

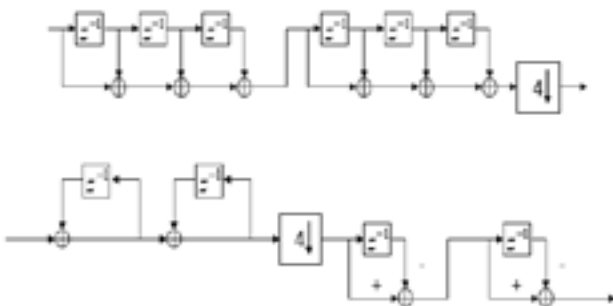
Dan Boschen has a MS in Communications and Signal Processing from Northeastern University, with over 25 years of experience in system and hardware design for radio transceivers and modems. He has held various positions at Signal Technologies, MITRE, Airvana and Hittite Microwave designing and developing transceiver hardware from baseband to antenna for wireless communications systems. Dan is currently at Microchip (formerly Microsemi and Symmetricom) leading design efforts for advanced frequency and time solutions.

For more background information, please view Dan's Linked-In page at: <http://www.linkedin.com/in/dan-boschen>

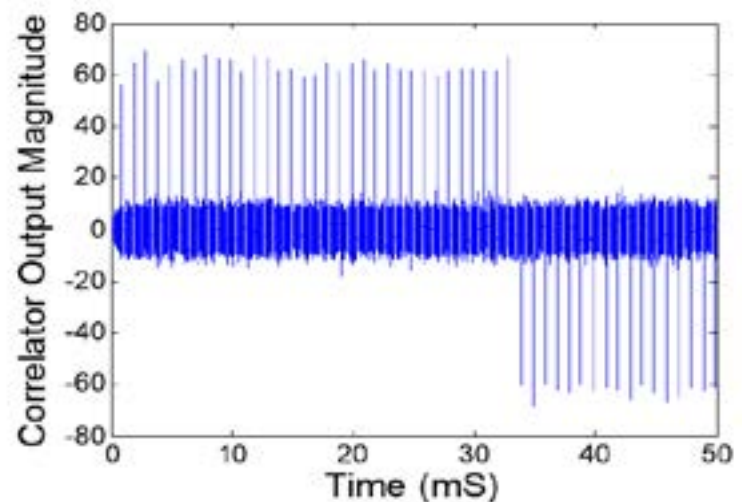
Linear Phase FIR Filter
(8-bit quantized filter coefficients)



Multi-stage CIC



Sliding Correlation



**Decision (Run/Cancel) Date for this Course is
Friday, April 12, 2024**

By April 11

IEEE Members

\$190

Non-members

\$210

After April 11

\$285

\$315

Python Applications for Digital Design and Signal Processing

Dates & Times: Course Kick-off/Orientation, 6 - 6:30PM ET, Thursday, February 29
 Live Workshops: 6:00 - 7:30PM ET; Thursdays, March 7, 14, 21, 28
 First Video Release, Thursday, February 29, 2024, additional videos released weekly in advance of that week's live session!

Speaker: Dan Boschen
Location: Zoom

This is a hands-on course combining pre-recorded lectures with live Q&A and workshop sessions in the popular and powerful open-source Python programming language.

Course Information will be distributed on Thursday, February 29 in advance of and in preparation for the first live workshop session. A live orientation session will be held on February 29. Attendees will have access to the recorded session and exercises for two months (until May 28, 2024) after the last live session ends!

Pre-Recorded Videos: The course format includes pre-recorded video lectures that students can watch on their own schedule, and an unlimited number of times, prior to live Q&A workshop sessions on Zoom with the instructor. The videos will also be available to the students for viewing for up to two months after the conclusion of the course.

Overview: Dan provides simple, straight-forward navigation through the multiple configurations and options, providing a best-practices approach for quickly getting up to speed using Python for modelling and analysis for applications in signal processing and digital design verification. Students will be using the Anaconda distribution, which combines Python with the most popular data science applications, and Jupyter Notebooks for a rich, interactive experience.

The course begins with basic Python data structures and constructs, including key "Pythonic" concepts, followed by an overview and use of popular packages for scientific computing enabling rapid prototyping for system design.

During the course students will create example designs including a sigma delta converter and direct digital synthesizer both in floating point and fixed point. This will include considerations for cycle and bit accurate models useful for digital design verification (FPGA/ASIC), while bringing forward the signal processing tools for frequency and time domain analysis.

Jupyter Notebooks: This course makes extensive use of Jupyter Notebooks which combines running Python code with interactive plots and graphics for a rich user experience. Jupyter Notebooks is an open-source web-based application (that can be run locally) that allows users to create and share visually appealing documents containing code, graphics, visualizations and interactive plots. Students will be able to interact with the notebook contents and use "take-it-with-you" results for future applications in signal processing.

Target Audience: This course is targeted toward users with little to no prior experience in Python, however familiarity with other modern programming languages and an exposure to object-oriented constructs is very helpful. Students should be comfortable with basic signal processing concepts in the frequency and time domain. Familiarity with Matlab or Octave is not required, but the equivalent operations in Python using the NumPy package will be provided for those students that do currently use Matlab and/or Octave for signal processing applications.

Benefits of Attending / Goals of Course: Attendees will gain an overall appreciation of using Python and quickly get up to speed in best practice use of Python.

Topics / Schedule:

Pre-recorded lectures (3 hours each) will be distributed Friday prior to each week's workshop dates. Workshop/ Q&A Sessions are 6 - 7:30PM on the dates listed below:

Kick-off / Orientation: February 29**Class 1 March 7**

Topic 1: Intro to Jupyter Notebooks, the Spyder IDE and the course design examples. Core Python constructs.

Class 2 March 14

Topic 2: Core Python constructs; iterators, functions, reading writing data files.

Class 3 March 21

Topic 3: Signal processing simulation with popular packages including NumPy, SciPy, and Matplotlib.

Class 4 March 28

Topic 4: Bit/cycle accurate modelling and analysis using the design examples and simulation packages

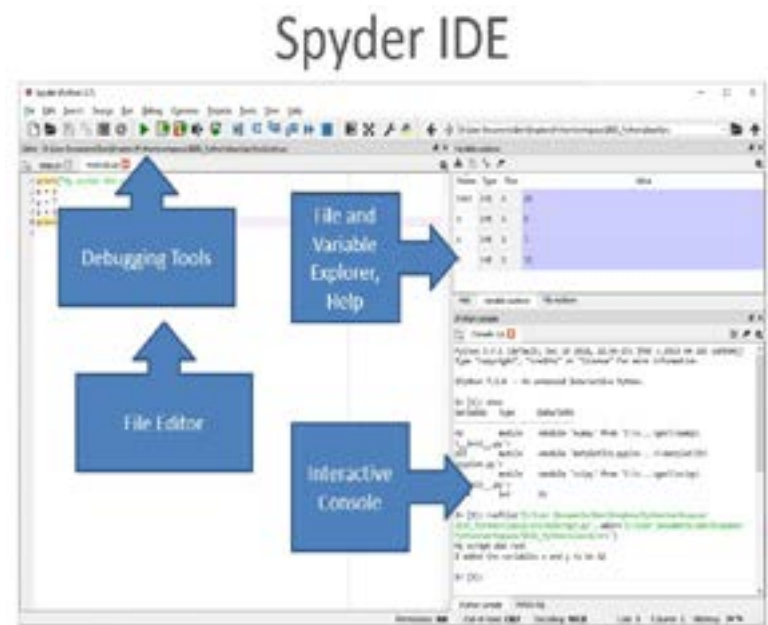
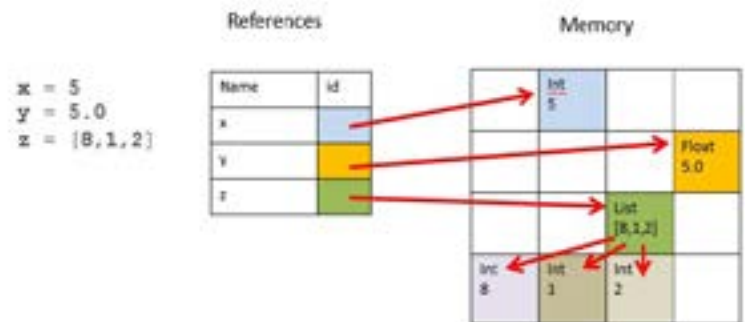
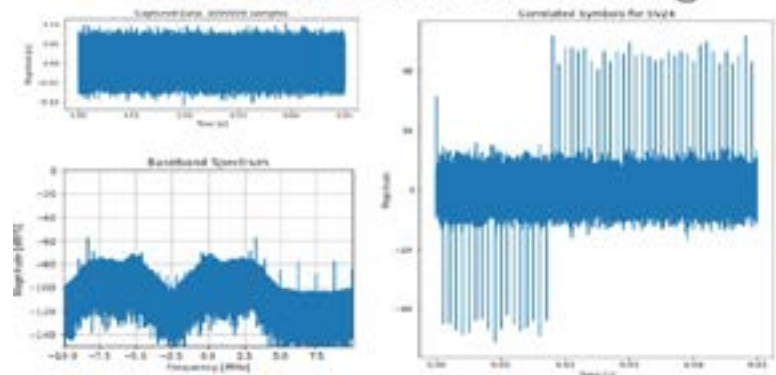
Speaker's Bio: Dan Boschen has a MS in Communications and Signal Processing from Northeastern University, with over 25 years of experience in system and hardware design for radio transceivers and modems. He has held various positions at Signal Technologies, MITRE, Airvana and Hittite Microwave designing and developing transceiver hardware from baseband to antenna for wireless communications systems and has taught courses on DSP to international audiences for over 15 years. Dan is a contributor to Signal Processing Stack Exchange <https://dsp.stackexchange.com/>, and is currently at Microchip (formerly Microsemi and Symmetricom) leading design efforts for advanced frequency and time solutions.

For more background information, please view Dan's Linked-In page (<https://www.linkedin.com/in/dan-boschen/>)

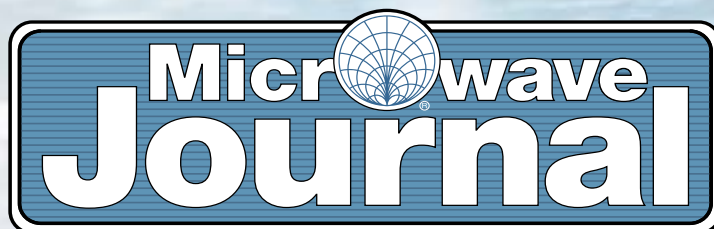
Registration is open through the last live workshop date. Live workshops are recorded for later use.

Decision (Run/Cancel) Date for this Course is Thursday, February 22, 2024

Payment	On/by March 20	After March 20
IEEE Members	\$190	\$285
Non-members	\$210	\$315

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