The IEEE Reliability Society

Joint Section Chapter: Boston - New Hampshire - Providence

March 2024

https://r1.ieee.org/boston-rl/

Welcome to the Boston Chapter Newsletter:

Our December 2023 meeting honored all chapter Chairs for their volunteer service to our chapter at a hybrid meeting hosted by MIT Lincoln Labs. Six were able to attend in person, and two more were on the Zoom conference call from Europe and Florida.

Officer Election results were announced as follows:

Jay Yakura as Chair
Dan Weidman as Vice Chair
Don Markuson as Secretary and Treasurer

Four meetings were held during the last four months.

- Dec. 2023: Dr. Mohammad Pourgol presented “Complex Electronics Reliability and Life Modeling Based on Physics of Failure Simulation.”
- Jan. 2024: Arun Gowtham presented “Transforming Reliability with AI – Machine Learning & Artificial Intelligence”
- Feb. 2024: Dr. Jian Cao presented “Analyzing Time-to-Event Data: A Comparison between Reliability and Survival Methods”
- Mar. 2024 Priscila Silva, Ph.D. candidate presented “Regression and Time Series Mixture Approaches to Predict Resilience”

See Meeting Highlights below.

Meeting Highlights:

December 13, 2023 – Hybrid event – 27 participants:

"Complex Electronics Reliability and Life Modeling Based on Physics of Failure Simulation"

Dr. Mohammad Pourgol, Safety/Reliability Analyst, Teradyne
and Associate Professor (adj), Mechanical Engineering, University of Maryland

Mohammad presented physics of failure (PoF) simulations as an alternative to the traditional reliability methods of statistical models, MTBF estimations, and testing especially when modeling extremely complex systems where testing may be financially prohibitive. Using PoF models to understand electronics root causes and interactions of failures, such as device degradation, fatigue, fracture, wear, and corrosion, and to predict the system reliability and life expectancy under different operating conditions and environments may allow more reliable products to be produced with lower costs. PoF can also incorporate probabilistic methods to account for the uncertainties and variabilities in the system parameters, materials properties, loading conditions, and failure mechanisms. Sample analyses using Ansys Sherlock modeling software and library were presented, and additional research continues to expand the documented cases.

A Zoom recording of the presentation may be found at the following link:
Physics of Failure 12-13-2023 Passcode: 4=$XI0!+
Complex-Reliability-Modeling-slides.pdf

January 17, 2024 – Webinar - 23 participants

"Transforming Reliability with AI – Machine Learning & Artificial Intelligence"

Arun Gowtham, Reliability Consultant, Apex Ridge Reliability

Arun presented the application of AI to augment reliability and maintenance tasks to implement Predictive Maintenance (PdM) programs where repair work is planned and executed at optimal times. A strategic framework is needed to plan, execute, and sustain an AI program and varies by application. Utilizing existing and new algorithms to predict machine failures empowers reliability engineers with information used to manage design iterations, repair work, spare parts, and production. This approach reduces reacting to failures after a breakdown that could result in huge losses. Armed with this predictive data project teams may be proactive and more efficient. Data-intensive exercises of reliability testing, verification and validation, and fleet monitoring can be improved vastly by deploying real-time sensor monitoring and AI prediction tools.

A Zoom recording of the presentation and slides may be found at the following links:
Machine_Learning_and_AI Passcode: g&A612q!
Machine_Learning_and_AI_Slides

February 7, 2024 – Hybrid event – 23 participants

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

Dr. Jian Cao, JMP

Jian presented the parallels and distinctions between the two statistical methods for time-to-event data related to reliability and survival analysis. Many classic reliability analysis tools are also used in clinical trials and epidemic research. A variety of parametric distributions and acceleration factors are used in reliability analyses, while non-parametric and semi-parametric methods are favored in clinical analyses. Real-life cases were demonstrated with JMP software.

Medical researchers estimate metrics like treatment effect and risk factors. Their analysis approach is an ANOVA of complex Design of Experiments trying to predict the survival probabilities related to disease severity, relapse, or death from treatment comparisons. One example presented was a spectrum of cancer types, the stages of the patients, and treatments at different frequencies and/or concentrations. He also spoke of social science models for marketing or HR retention of customers or employees, respectively. These were compared to the variety of failure modes produced with a spectrum of acceleration factors applicable to traditional technology reliability.

A Zoom recording of the presentation and slides may be found at the following links:
Reliability_and Survival_Methods Passcode: D.S?0dWn
Reliability_and_Survival_Methods_Slides

March 6, 2024 – Hybrid event – 33 participants

A joint meeting with Boston Section Life Member Affinity Group and WIE - Women in Engineering Society

"Regression and Time Series Mixture Approaches to Predict Resilience"

Priscila Silva, Ph.D. candidate, Electrical and Computer Engineering UMass Dartmouth

Priscila presented research on resilience engineering, which is the ability to build and sustain a system that can deal effectively with disruptive events. Her goal was to predict how system performance changes when exposed to multiple shocks/stresses of different intensity and duration, provide structure for planning tests to assess system resilience against them, and guide data collection necessary to conduct tests effectively. She presented baseline concepts combining classic reliability and survivability to evaluate approaches for the process to model system resilience based on (i) regression, (ii) time series, and (iii) mixed regression and time series.

A historical data set on job losses during the 1980 recessions in the United States was

used to assess the predictive accuracy of these approaches. Models that combined regression and time series were most effective in accounting for changes in performance due to immediate and latent effects from disruptions, demonstrating superior performance in long-term predictions, and higher goodness-of-fit, despite increased parametric complexity. Variations of the domain conditions causing disruptions is pivotal to how predictions are generated, as the same model did not work for other recessions as compared to the 1980 model. Her models have expanded to combining eleven linear-regressive and multi-variant vector auto-regressive models, and her results are being compared with those of other PhD candidates attempting AI predictions from the same data.

Due to technical difficulties, the end of Ms. Silva's talk was assisted by Vice Chair Dan Weidman displaying the slides.

A Zoom recording of the presentation and slides may be found at the following links:
Resilience Modeling Passcode: iEKV90^D
Resilience_Modeling_Slides

Upcoming Activities (target dates)

Future Presentations: April 10, May 8, and June 12, 2024 – TBD - flexible dates.

Looking for speakers. Contact Jay Yakura or Dan Weidman if interested.

AdCom meetings: April 2, May 14, and June 25.

Requests to enroll for email invitations may go to Jay Yakura Chair, (james.yakura@ieee.org).

Meeting invitations, presentation slides and newsletters may be found here: https://r1.ieee.org/boston-rl/.

Advisory Committee (AdCom) Members 2024

Chair: Jay Yakura – Retired james.yakura@ieee.org
Vice Chair: Dan Weidman – MIT Lincoln Laboratory danweidman@ieee.org
Secretary: Don Markuson – Silicon Labs d.markuson@ieee.org
Treasurer: Don Markuson – Silicon Labs d.markuson@ieee.org

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Mohammad Pourgol, Teradyne – mohammad.pourgol@teradyne.com

Chapter Seeks Volunteers

The IEEE mission is Advancing Technology of Humanity.
The IEEE Reliability Society mission is Promoting recognition of the reliability profession, developing, and disseminating reliability best practices, and being a resource for collaboration among reliability professions.

As a volunteer organization, our success is directly related to having people like you involved in the planning and execution of our meetings and communication processes.

We welcome new members to the Advisory Committee and discussion questions.

You may find URL links to all the meetings on https://events.vtools.ieee.org, - search for region 1, section Boston, CH01021. For updates on upcoming events see the IEEE Spectrum or contact Jay Yakura james.yakura@ieee.org or Dan Weidman danweidman@ieee.org to be added to our notification list or our Advisory Committee. Your contributions may be as much or as little as you would like.

Consider Reliability Society Membership

Society Membership includes:
- Society Newsletter,
- IEEE Transactions on Reliability,
- IEEE Reliability Society Conference Digital Library, and
- IEEE Reliability Society Resource Center.

Readers can contact chapter newsletter editor Mary Jones (maryajones@ieee.org) with any comments, suggestions, or if interested in contributing to our next issue.

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