67th ANNUAL FALL TECHNICAL CONFERENCE

Big Data, Big Energy: Innovations in Quality, Statistics, and Data Science

Houston Marriott Sugar Land

Houston, TX

October 7 - 9, 2025

Co-sponsored by:

ASQ
Excellence Through Quality™

Chemical & Process Industries Division
Statistics Division

ASA
AMERICAN STATISTICAL ASSOCIATION
Promoting the Practice and Profession of Statistics®

Section on Physical & Engineering Sciences
Quality & Productivity Section

Shewell Award scoring is now online!

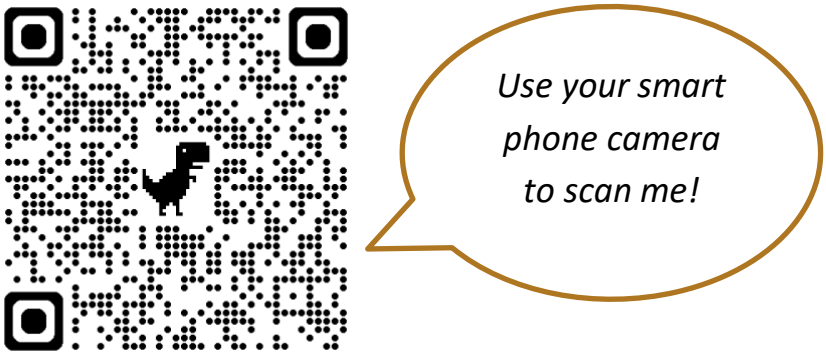
About the Award

The Shewell Award is awarded to the best contributed paper at FTC, as judged by conference participants as well as a panel of judges after the event. The prize will be awarded at next year's conference and includes a $1,000 monetary award, free registration at next year's conference, and hotel expenses. The award is based on two broad categories of criteria:

1. Oral presentation (60%) as rated by attendee's evaluation as provided on this form
2. Written material (40%), rated by a panel of judges based on quality of subject matter, scientific merit, applicability and originality

Two ways to access

1. **Use your smartphone and the QR code**: scan the QR code below with your smartphone. Most iPhones and Android smartphones can navigate you directly to the survey website just using your camera. Alternatively, you can use a QR scanning app that you have already installed on your phone.



2. **Navigate to the following web link and bookmark it in your smartphone browser.**

https://tinyurl.com/ShewellAward

The Shewell Award scoring will not be done using paper forms this year.
Thanks for your understanding!

67th Annual Fall Technical Conference

Big Data, Big Energy: Innovations in Quality, Statistics, and Data Science

Dear Attendee,

It is my pleasure to welcome you to Houston and the 2025 ASQ/ASA Fall Technical Conference! The Fall Technical Conference brings together researchers and practitioners from academia, industry, and government to discuss ways to more effectively use statistical methods for research, innovation, and quality improvement. The conference is co-sponsored by the American Society for Quality (Chemical & Process Industries Division and the Statistics Division) and the American Statistical Association (Section on Physical & Engineering Sciences and the Quality & Productivity Section).

This year's theme, "Big Data, Big Energy: Innovations in Quality, Statistics, and Data Science," alludes to Houston's roots in the energy industry and highlights the vital roles that quality, statistics, and data science play in the digital transformation. The conference begins with short courses on Tuesday that provide training in areas in quality, statistics, and data science. **An opening reception will be held Tuesday evening and I encourage more seasoned attendees to approach new faces to build the FTC fellowship for this year and the future.** Wednesday and Thursday are packed with outstanding sessions organized by the FTC technical program committee, focusing on new methods and applications in design of experiments, quality control, and artificial intelligence. Wednesday evening will feature the inaugural poster session with a reception. The conference concludes on Thursday afternoon with a reception and SPES panel discussion titled *Digital Twins in Industry and Academia*.

The plenary speakers are, as always, high points of the conference. Dr. Scott Vander Wiel (Los Alamos National Laboratory) is this year's Gerald J. Hahn Achievement Award winner and will give the opening plenary about his experiences in collaborative problem solving and mentoring. Dr. Christopher J. Nachtsheim (University of Minnesota, Carlson School of Management) will give the WJ Youden Address, in which he will discuss how design of experiments can be used to discover and characterize cause-and-effect relationships. I am also excited about this year's lunch speakers! On Wednesday, Samantha-Anne Horwitch Nadolny (Houston Livestock Show and Rodeo Speakers Committee) will share an overview and history of rodeo and its economic impact on the City of Houston. Thursday's lunch features ASA President Dr. Ji-Hyun Lee (University of Florida) will share how everyday statisticians use statistical thinking and leadership to drive science and patient care.

Last, but not least, I would like to thank everyone involved in this year's conference for all their hard work. Thanks to the FTC steering committee for their constant support and guidance, thanks to the Technical Program Committee led by Karen Hulting (STAT), and the Short Course Committee led by Caleb King (STAT). I would also like to thank the other conference committee members who helped with so many important details: Sharad Prabhu as FTC Treasurer, John Szarka as Exhibitor & Sponsor Chair, and Adam Pintar as Webmaster. Special thanks also to Jon Stallrich as the previous FTC chair.

I hope that you enjoy your time in Houston and at FTC, especially the great presentations, networking opportunities, luncheons, and evening receptions.

Sincerely,
Jennifer Kensler, Shell
2025 FTC General Conference Chair
jennifer.kensler@shell.com

Exhibitors & Sponsors

Special thanks to our exhibitors and sponsors for helping to continue FTC's great tradition!

Exhibitors

Exhibitors will showcase their products on Wednesday and Thursday in the Exhibitor Area outside Sugar Land Ballrooms VI and VII. Be sure to stop by to learn more!

For over 75 years, Virginia Tech's Department of Statistics has advanced the field through methodological research in a diverse set of traditional and emerging application areas. Students gain real-world experience through practice-oriented collaborative opportunities in the Statistical Applications and Innovations Group (SAIG), internships for credit, and strong Corporate Partner relationships. Learn more at www.stat.vt.edu.

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Congratulations to our student and early career grant award winners!

Student

Steven Barnett, *Virginia Tech*
Madison De Boer, *Baylor University*
Mingang Kim, *Virginia Tech*
Yue Ma, *The Ohio State University*
Ayumi Mutoh, *North Carolina State University*
Parul Patil, *Virginia Tech*
Xiankui Yang, *University of South Florida*
Xietao Zhou, *King's College London*

Early Career

Annie Booth, *Virginia Tech*

We would like to thank the ASA Quality and Productivity Section, ASQ Chemical and Process Industries Division, and an anonymous donor for proving these awards.

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Conference Event Times & Locations

All locations are at the Houston Marriott Sugar Land

Tuesday, October 7

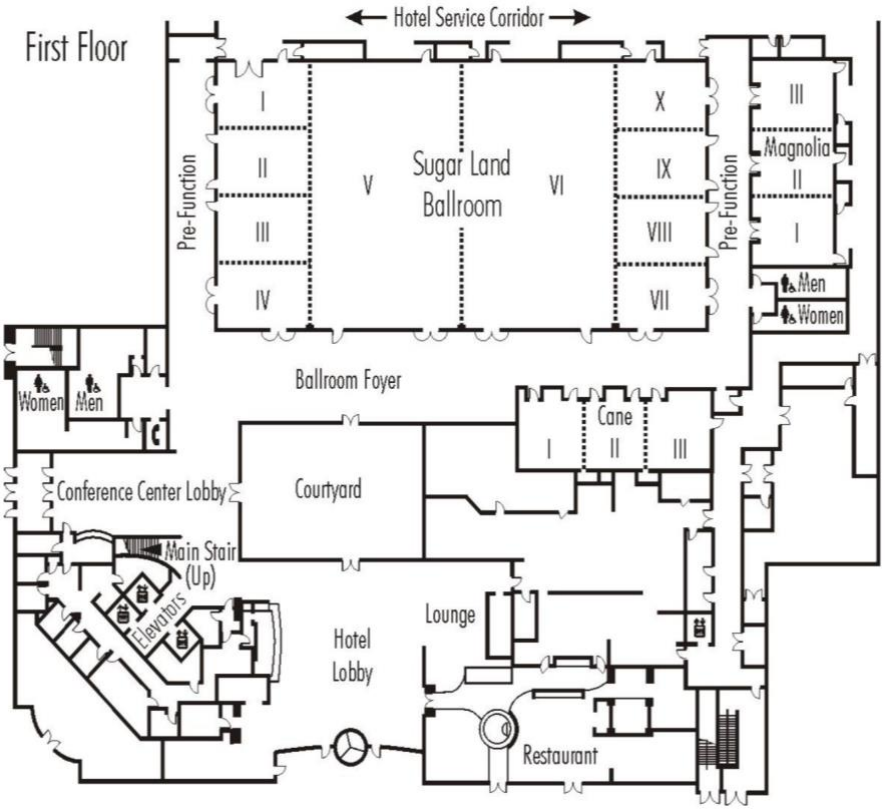
7:30am – 8:00am	Registration	Sugar Land Foyer
8:00am – 5:00pm	Short Courses	Cane II
11:30am – 12:00pm	Registration	Sugar Land Foyer
12:00pm – 1:00pm	Lunch	Burning Pear Restaurant
5:30pm – 7:00pm	FTC Opening Reception	Sugar Land Foyer

Wednesday, October 8

7:00am – 8:00am	Registration	Sugar Land Foyer
7:00am – 8:00am	Breakfast	Sugar Land Foyer
7:30am – 5:30pm	Exhibits	Sugar Land Foyer
8:00am – 9:00am	Welcome & Plenary Session	Sugar Land VI
9:15am – 10:00am	Parallel Sessions 1	A: Sugar Land VII B: Sugar Land VIII C: Cane I & II
10:00am – 10:30am	Morning Break	Sugar Land Foyer
10:30am – 12:00pm	Parallel Sessions 2	A: Sugar Land VII B: Sugar Land VIII C: Cane I & II
12:15pm – 1:45pm	Lunch and Plenary Session	Sugar Land VI
2:00pm – 3:30pm	Parallel Sessions 3	A: Sugar Land VII B: Sugar Land VIII C: Cane I & II
3:30pm – 4:00pm	Afternoon Break	Sugar Land Foyer
4:00pm – 5:00pm	W.J. Youden Address	Sugar Land VI
5:00pm – 6:00pm	Reception and Poster Session	Sugar Land VI

Thursday, October 9

7:00am – 8:00am	Registration	Sugar Land Foyer
7:00am – 8:00am	Breakfast	Sugar Land Foyer
7:30am – 2:30pm	Exhibits	Sugar Land Foyer
8:00am – 9:30am	Parallel Sessions 4	A: Sugar Land VII
		B: Sugar Land VIII
		C: Cane I & II
9:30am – 10:00am	Morning Break	Sugar Land Foyer
10:00am – 11:30am	Parallel Sessions 5	A: Sugar Land VII
		B: Sugar Land VIII
		C: Cane I & II
11:45am – 1:15pm	Lunch and Plenary Session	Sugar Land VI
1:30pm – 3:00pm	Parallel Sessions 6	A: Sugar Land VII
		B: Sugar Land VIII
		C: Cane I & II
3:15pm – 5:15pm	Reception and	
	SPES Panel Discussion	Sugar Land VI



Technical Program At-A-Glance Schedule: Tuesday, Oct 7

8:00a – 12:00p	**Half-Day Short Course** Cane II *A Practitioner's Guide to Optimal Design* Jon Stallrich, North Carolina State University *Additional fees apply*
12:00p – 1:00p	**Luncheon** Burning Pear Restaurant *Additional fees apply*
1:00p – 5:00p	**Half-Day Short Course** Cane II *Practical Experimentation: Improving the Logistics of Experiment Management* Mindy Hotchkiss, Enquery Research *Additional fees apply*
5:00p – 7:00p	**Fall Technical Conference Opening Reception** Sugar Land Foyer

AM Half-Day Short Course: Tuesday, October 7

The AM half-day short course will be held on Tuesday, October 7 from 8:30AM to 12:30PM

A Practitioner's Guide to Optimal Design

Jon Stallrich, North Carolina State University

Cane II

Abstract: What makes one experimental design better than another? In this short course, I will first introduce a general optimal design framework that answers this question by ranking designs according to a so-called "design criterion" that summarizes the amount of statistical information held by a design. Popular design criteria, such as the D- and A-criterion, that seek to minimize estimation variances will be discussed and compared. This comparison will spark a discussion on the importance of choosing an appropriate design criterion to match your analysis goals, leading to an introduction to more flexible variance-based criteria and criteria to minimize estimator bias. Computational search algorithms will be presented to help identify optimal (or nearly optimal) designs for a general criterion. R code will be provided that perform these search algorithms. Examples will focus on one factor studies, factorial experiments, and response surface designs. By the end of the course, participants will be experts in the general optimal design framework; be familiar with popular optimality criteria targeting the variance and bias of least-squares estimators; and be able to program design search algorithms to optimize a general criterion.

PM Short Course: Tuesday, October 7

The PM half-day short course will be held on Tuesday, October 7 from 1:30PM to 5:30PM

Practical Experimentation: Improving the Logistics of Experiment Management

Mindy Hotchkiss, Enquery Research

Cane II

Abstract: The process of creating statistically structured designed experiments, known as the Design of Experiments (DOE/DOX), is widely recognized as best practice for test planning. It is used in countless fields and industries to facilitate knowledge development and establish causality, which is foundational to repeatable research. DOE is a multipurpose tool that uses balance and structure to effectively characterize, improve, and optimize systems and processes. However, good test practices are critical for obtaining robust results that can be reproduced by other experimenters, enabling extension into further research.

The objective of experimentation is, in its simplest form, attempting to detect a signal clouded by some degree of noise (e.g. natural process variability). For example, the most common form is to establish if a change in factor X is inducing an effect in some response Y. Statistical analysis methods are used to quantitatively differentiate the signal from the noise. However, there are any number of logistical reasons that could contribute to why a particular signal could not be detected, such as poor factor level selection, suboptimal blocking, high measurement variability in independent and dependent variables, unstable test

setup, improper data post-processing, etc.. To improve the clarity of experimental results, there are two options: one must either increase the signal, decrease the noise, or some combination of the two.

Since experiments rarely if ever have an opportunity to be redone, decisions made during the test planning process have the potential for enormous downstream consequences for the outcome of the entire experiment. It is critical that experimenters consider what could contribute to noise during the test planning process, in order to most effectively achieve the benefits of the investment made in planned testing. This course will discuss practical test strategies to both enhance the signal and reduce noise, as well as general experimental practices that can be utilized during the experimental design and test planning process, as well as implementation. The objective of this course is to provide a resource for practitioners, those implementing experiments, both as statisticians and other subject-matter experts involved in projects as part of cross-functional teams.

Notes

Technical Program At-A-Glance Schedule: Wednesday, Oct 8

8:00a – 9:00a	**Welcome & Plenary Session** **Presentation of the Gerald J. Hahn Q&P Achievement Award** *Enthusiastic Collaboration and Mentoring* Scott Vander Wiel, Los Alamos National Laboratory Sugar Land VI		
	Sugar Land VII	Sugar Land VIII	Cane I & II
9:15a – 10:00a	**1A:** *Assessing Predictive Capability for Binary Classification Models* Mindy Hotchkiss, Enquery Research LLC **Moderator:** Qiong Zang	**1B:** *Optimal Design of Experiments for Powerful Equivalence Testing* Peter Goos and Ying Chen, KU Leuven **Moderator:** Byran Smucker	**1C:** *Can ChatGPT Think Like a Quality and Productivity Professional?* Jennifer Van Mullekom and Anne Driscoll, Virginia Tech **Moderator:** Daksha Chokshi
10:30a – 12:00p	**2A: Quality Control** *Monitoring Parametric, Nonparametric, and Semiparametric Linear Regression Models using a Multivariate CUSUM Bayesian Control Chart* Abdel-Salam G. Abdel-Salam, Qatar University *To Drive Improvement: Act on Every Count* James Lucas, J. M. Lucas and Associates **Moderator:** Di Michelson	**2B: Modeling** *Vecchia Approximated Bayesian Heteroscedastic Gaussian Processes* Parul Vijay Patil, Virginia Tech *Impact of the Choice of Hyper-parameters on Statistical Inference of SGD Estimates* Yeng Saanchi, JMP **Moderator:** Steven Barnett	**2C: Technometrics Invited** *Screening Designs for Continuous and Categorical Factors* Ryan Lekivetz, JMP *Rerandomization Algorithms for Optimal Designs of Network A/B Tests* Qiong Zhang, Clemson **Moderator:** Maria Weese
12:15p – 1:45p	**Luncheon** *History and Happenings of the Houston Livestock Show and Rodeo* Samantha-Anne Horwitch Nadolny, Houston Livestock Show and Rodeo Speakers Committee Sugar Land VI		
2:00p – 3:30p	**3A: STAT Invited Session** *Probability of Detection: Evaluating the Reliability of Nondestructive Inspection Systems* Christine Knott, Air Force Research Laboratory *Experimental Design and Sample Size Considerations in Reliability Studies Using Probability of Detection for Nondestructive Evaluation* Christine Schubert Kabban, Air Force Institute of Technology **Moderator:** Karen Hulting	**3B: JQT Invited Session** *A Scalable Algorithm for Generating Non-uniform Space Filling Designs* Xiankui Yang, University of South Florida *A Critique of Neutrosophic Statistical Analysis Illustrated with Interval Data from Designed Experiments* William Woodall, Virginia Tech **Moderator:** Rong Pan	**3C: DOE** *Large Row-Constrained Supersaturated Designs for High-throughput Screening* Byran Smucker, Henry Ford Health *Optimizing User Experience in Statistical Tools through Experimental Design* Jacob Rhyne and Mark Bailey, JMP **Moderator:** Peter Goos

4:00p – 5:00p	**W. J. Youden Address** *Design of Experiments: The Key to the Cause-and-Effect Kingdom* Christopher Nachtsheim, University of Minnesota, Carlson School of Management Sugar Land VI
5:00p – 6:00p	**Reception and Poster Session** Sugar Land VI *Introducing Continuous Restrictions into Spatial Models via Gaussian Random Fields with Linear Boundary Constraints* Yue Ma, The Ohio State University *Scale-Location-Truncated Beta Regression: Expanding Beta Regression to Accommodate 0 and 1* Mingang Kim, Virginia Tech *Pitfalls and Remedies for Maximum Likelihood Estimation of Gaussian Processes* Ayumi Mutoh, North Carolina State University *Monitoring Functional Anomalies in a Water Treatment Process* Hunter Privett, Baylor University *Optimal Experimental Designs Robust to Missing Observations* Jace Ritchie, Sandia National Laboratories

Welcome & Plenary Session, Gerald J. Hahn Achievement Award

Wednesday, October 8, 8:00 – 9:00am ASA Q&P Presiding

Sugar Land VI

Enthusiastic Collaboration and Mentoring

Scott Vander Wiel, Los Alamos National Laboratory

Abstract: This is a three-part talk. First, I will reflect on Gerry Hahn who, with others, mentored me during two summers at the General Electric Corporate R&D Center beginning 37 years ago. I will discuss some highlights of this privilege, including Gerry's enthusiastic and supportive mentoring style and his encouragement to dive into the world of collaborative industrial statistics for improving manufacturing processes and product quality.

Second, I will present new work from my own recent collaborations and mentoring—namely, co-active subspace methods (CoASM) for adjacent computer models. CoASM locates directions in the parameter input space that maximally drive the outputs of two adjacent computer models in the most similar fashion. This new work extends CoASM to functional outputs, inspired by tests of high explosives that are set off within cylinders made of various metals.

Third, I will offer a variety of insights from a career's-worth of advancing statistical methods through collaborative problem solving with physical scientists and engineers. in forward-looking research environments. These include the value of teaming with other statisticians, dealing with terminology differences, diving into the science or engineering deep end, coming up for statistical fresh air, and enjoying shared successes.

Notes

Session 1A:

Wednesday, October 8, 9:15 – 10:00am Moderator: Qiong Zang

Sugar Land VII

Assessing Predictive Capability for Binary Classification Models

Mindy Hotchkiss, Enquery Research LLC

Abstract: Classification models for binary outcomes are in widespread use across a variety of industries. Results are commonly summarized in a misclassification table, also known as an error or confusion matrix, which indicates correct vs incorrect predictions for different circumstances. Models are developed to minimize both false positive and false negative errors, but the optimization process to train/obtain the model fit necessarily results in cost-benefit trades. However, how to obtain an objective assessment of the performance of a given model in terms of predictive capability or benefit is less well understood, due to both the rich plethora of options described in literature as well as the largely overlooked influence of noise factors, specifically class imbalance. Many popular measures are susceptible to effects due to underlying differences in how the data are allocated by condition, which cannot be easily corrected.

This talk considers the wide landscape of possibilities from a statistical robustness perspective. Results are shown from sensitivity analyses for a variety of different conditions for several popular metrics and issues are highlighted, highlighting potential concerns with respect to machine learning or ML-enabled systems. Recommendations are provided to correct for imbalance effects, as well as how to conduct a simple statistical comparison that will detangle the beneficial effects of the model itself from those of imbalance. Results are generalizable across model type.

Session 1B:

Wednesday, October 8, 9:15 – 10:00am Moderator: Byran Smucker

Sugar Land VIII

Optimal Design of Experiments for Powerful Equivalence Testing

Peter Goos and Ying Chen, KU Leuven

Abstract: In manufacturing, an optimized process typically operates under a target condition with specific parameter settings. Products produced under this condition meet the desired quality standards. However, these parameters can inevitably deviate from their target settings during routine production. For instance, the actual pH level of a blend may differ from the target setting due to variability in the materials used to calibrate the pH meter. Similarly, production delays can cause the actual temperature of a material to vary by a few degrees from its target setting. To assess whether products still meet quality specifications despite these uncontrollable variations in process parameters, manufacturers can conduct an equivalence study. In such studies, the ranges of the process parameters correspond to the upper and lower bounds of the observed deviations from the target settings, referred to as the normal operating ranges. The manufacturer

then compares the quality attributes of products produced within the normal operating ranges of the process parameters to those produced under the target condition. If the differences in quality fall within an acceptable range, the products are considered practically equivalent, indicating that the manufacturing process is robust and capable of consistently producing quality products.

In this presentation, we adapt existing methods for calculating power in bioequivalence studies to the context of industrial experimental design. We also introduce a novel design criterion, termed "PE-optimality," to generate designs that allow for powerful equivalence testing in industrial experiments. An adequate design for equivalence testing should provide a high probability of declaring equivalence of the mean responses at various locations within the normal operating ranges of process parameters and the mean response at the target condition, when equivalence truly holds. The PE-optimality design criterion achieves this by performing prospective power analyses at a large number of locations within the experimental region and selecting a design that ensures sufficiently high power across a substantial portion of the region.

Session 1C:

Wednesday, October 8, 9:15 – 10:00am Moderator: Daksha Chokshi

Cane I & II

Can ChatGPT Think Like a Quality and Productivity Professional?

Jennifer Van Mullekom and Anne Driscoll, Virginia Tech

Abstract: As the capability of generative AI (GenAI) evolves at a rapid pace, organizations are eager to leverage it for efficiency gains. Various GenAI tools include a data analysis component. More than any other disruptive technology in recent years, GenAI has the potential to change both how data analysis is accomplished and by whom. Subsequently, it will change how we educate those that pose data centric questions and try to answer them in the future.

With all the buzz and the hype, we were curious: "Can ChatGPT Think Like a Quality and Productivity Professional?" Come to the talk and we'll let you know the answer. Through a pilot at Virginia Tech, faculty and graduate students are evaluating the ChatGPT EDU Advanced Data Analytics tool. Our evaluation is none other than a systematic one using a designed experiment. (After all, we are quality and productivity professionals!) Our evaluation spans across select prompt types, specificity of the prompts, and applications in Quality and Productivity. Results will be reported in a quantitative and qualitative way. Our talk will include a brief overview of GenAI for data analysis, an overview of our study design, use case examples, and the results of our pilot culminating in recommendations and best practices which you can leverage regardless of your position or organization.

Notes

Session 2A: Quality Control

Wednesday, October 8, 10:30am – 12:00pm Moderator: Di Michelson

Sugar Land VII

Monitoring Parametric, Nonparametric, and Semiparametric Linear Regression Models using a Multivariate CUSUM Bayesian Control Chart

Abdel-Salam G. Abdel-Salam, Qatar University

Abstract: In this work we develop a Bayesian multivariate cumulative sum (mCUSUM) control chart for monitoring multiple response variables for count data using their coefficients. We use the squared error loss function for parameter estimation of models fit using parametric, nonparametric, and semiparametric regression methods. We deploy the nonparametric penalized splines (p-splines) and semiparametric model robust regression 1 (MRR1) methods, comparing the regression accuracy on their mean squared error (MSE), Akaike information criterion (AIC) and Bayesian information criterion (BIC). To assess the chart's out-of-control detection capabilities, we perform simulation studies for both the hyperparameters and sample size. After the results are confirmed, we provide a real application on suicide count data made available by the World Health Organization (WHO) to predict and monitor global suicide rates.

To Drive Improvement: Act on Every Count

James Lucas, J. M. Lucas and Associates

Abstract: The act on every count procedure (AOEC) is an effective way to drive improvement. It is useful when a count indicates the occurrence of an event of interest, usually an adverse event, and the goal is to reduce the occurrence of adverse events.

This talk will discuss the AOEC procedure. A unique aspect of this talk is that the title almost tells the whole story so a major part of the talk is a discussion of situations where the AOEC procedure has been successful in driving improvement. Two situations where the AOEC procedure has been successfully implemented are the FAA's approach to airline accidents and Dupont's benchmarked safety system. We then describe two situations where the AOEC procedure should be implemented. These situations are hospital errors and police killings of unarmed civilians. We also discuss barriers to the wider use of the AOEC procedure.

The DuPont Company's Product Quality Management manual differentiated between low-count and rare event quality problems. It stated: "A property that has a low count of nonconformances is presumed to be a phenomenon continuously (or at least often) present in normal product, even though only infrequently counted in a typical routine sample. A rare event quality problem is presumed to be entirely absent in all normal product, and to be due to a specific unusual malfunction in each specific instance of a quality breakdown. It is not always important to distinguish between these two categories of problems because the same counted data CUSUM technology is applied in either case." The last sentence refers to the fact that the DuPont PQM quality system used CUSUM for monitoring both variables and counts; it is the largest known CUSUM implementation. The AOEC procedure is a special case of a CUSUM, and also of a Shewhart monitoring procedure so it has all the optimality properties of both procedures. The rare event quality

problem model is more applicable for the AOEC procedure because each count is considered to be due to its own assignable cause. The goal action for the AOEC procedure is the removal of the assignable cause thereby driving improvement.

As background, "Detection Possibilities When Count Levels Are Low" (Lucas et al., 2025) will be discussed. A "portable" version of the 2-in- m control procedure for detecting an order-of-magnitude shift and a conceptual version of a detecting a doubling procedure will be provided. This background will quantify why it almost never feasible to detect shifts of a doubling or smaller when count levels are low. In low count situations the AOEC procedure should be considered.

Session 2B: Modeling

Wednesday, October 8, 10:30am – 12:00pm Moderator: Steven Barnett

Sugar Land VIII

Vecchia Approximated Bayesian Heteroscedastic Gaussian Processes

Parul Vijay Patil, Virginia Tech

Abstract: Many computer simulations are stochastic and exhibit input dependent noise. In such situations, heteroskedastic Gaussian processes (hetGPs) make for ideal surrogates as they estimate a latent, non-constant variance. However, existing hetGP implementations are unable to deal with large simulation campaigns and use point estimates for all unknown quantities, including latent variances. This limits applicability to small simulation campaigns and undercuts uncertainty quantification (UQ). We propose a Bayesian framework to fit hetGPs using elliptical slice sampling (ESS) for latent variances, improving UQ, and Vecchia approximation to circumvent computational bottlenecks. We are motivated by the desire to train a surrogate on a large (8-million run) simulation campaign for lake temperatures forecasts provided by the Generalized Lake Model (GLM) over depth, day, and horizon. GLM simulations are deterministic, in a sense, but when driven by NOAA weather ensembles they exhibit the features of input-dependent noise: variance changes over all inputs, but in particular increases substantially for longer forecast horizons. We show good performance for our Bayesian (approximate) hetGP compared to alternatives on those GLM simulations and other classic benchmarking examples with input-dependent noise.

Impact of the Choice of Hyper-parameters on Statistical Inference of SGD Estimates

Yeng Saanchi, JMP

Abstract: In an era where machine learning is pervasive across various domains, understanding the characteristics of the underlying methods that drive these algorithms is crucial. Stochastic Gradient Descent (SGD) and its variants are key optimization techniques within the broader class of Stochastic Approximation (SA) algorithms. Serving as the foundation for most modern machine learning algorithms, SGD has gained popularity due to its efficient use of inexpensive gradient estimators to find the optimal solution of an objective function. Its computational and memory efficiency makes it particularly well-suited for handling large-scale datasets or streaming data.

SGD and its variants are widely applied in fields such as engineering, computer science, applied mathematics, and statistics. However, due to early stopping, SGD typically produces estimates that are not exact solutions of the empirical loss function. The difference between the SGD estimator and the true minimizer is influenced by factors such as the observed data, the tuning parameters of the SGD method, and the stopping criterion. While these methods have been successful in a wide range of applications, SGD can be erratic and highly sensitive to hyper-parameter choices, often requiring substantial tuning to achieve optimal results.

To explore the impact of step size scheduling on SGD's accuracy and coverage probability, we conduct a simulation study. Additionally, we propose a new approach for hyper-parameter tuning that combines the double bootstrap method with the Simultaneous Perturbation Stochastic Approximation (SPSA) technique.

Session 2C: Technometrics Invited Session

Wednesday, October 8, 10:30am – 12:00pm Moderator: Maria Weese

Cane I & II

Screening Designs for Continuous and Categorical Factors

Bradley Jones, Ryan Lekivetz, Dibyen Majumdar & Christopher Nachtsheim

Abstract: In many screening experiments, we often need to consider both continuous and categorical factors. In this presentation, we introduce a new class of saturated designs that effectively address this need. These designs include m three-level continuous factors and m–1 two-level factors—either categorical or continuous—within just n = 2*m runs, where m is at least 4.

A major advantage of our approach is its flexibility: these designs are available for any even number of runs starting from 8. Depending on whether n is a multiple of 8, 4, or just 2, the designs exhibit varying degrees of orthogonality.

We demonstrate that these designs typically have power near one for identifying up to m active main effects when the signal-to-noise ratio is greater than 1.5.

Rerandomization Algorithms for Optimal Designs of Network A/B Tests

Qiong Zhang, Clemson

Abstract: A/B testing is an effective method to assess the potential impact of two treatments. For A/B tests conducted by IT companies like Meta and LinkedIn, the test users can be connected and form a social network. Users' responses may be influenced by their network connections, and the quality of the treatment estimator of an A/B test depends on how the two treatments are allocated across different users in the network. This paper investigates optimal design criteria based on some commonly used outcome models, under assumptions of network-correlated outcomes or network interference. We demonstrate that the optimal design criteria under these network assumptions depend on several key statistics of the random design vector. We propose a framework to develop algorithms that generate rerandomization designs meeting the required conditions of those statistics under a specific assumption. Asymptotic distributions of

these statistics are derived to guide the specification of parameters in the algorithms. We validate the proposed algorithms using both synthetic and real-world networks.

Notes

Luncheon

Wednesday, October 8, 12:15 – 1:45pm ASQ CPID Presiding

Sugar Land VI

History and Happenings of the Houston Livestock Show and Rodeo

Samantha-Anne Horwitch Nadolny,
Houston Livestock Show and Rodeo Speakers Committee

Abstract: The Houston Livestock Show and Rodeo is more than just a Texas tradition—it's a cultural phenomenon that blends heritage, education, entertainment, and economic vitality. This presentation offers a sweeping overview of the Rodeo's rich history, tracing its evolution from humble beginnings in 1932 to its current status as the world's largest livestock exhibition and rodeo.

We'll explore the Rodeo's profound impact on education through its expansive scholarship programs, which have awarded hundreds of millions of dollars to Texas students. The session will also highlight the Rodeo's significant economic contributions to the City of Houston, from job creation to tourism and local business growth.

You'll get a sneak peek at this year's lineup of shows, concerts, and competitions, along with a behind-the-scenes look at what a day at the Rodeo entails—from livestock auctions and carnival rides to championship bull riding and barbecue cook-offs.

This talk will deepen your appreciation for the Houston Livestock Show and Rodeo's enduring legacy and its vibrant role in shaping Houston's cultural and economic landscape.

Notes

Session 3A: STAT Invited Session

Wednesday, October 8, 2:00 – 3:30pm Moderator: Karen Hulting

Sugar Land VII

Probability of Detection: Evaluating the Reliability of Nondestructive Inspection Systems

Christine Knott, Air Force Research Laboratory

Abstract: The reliability of nondestructive inspection (NDI) systems is estimated using statistical methods, the most thorough of which is the Probability of Detection (POD) methodology. The Department of the Air Force uses periodic nondestructive re-inspection of critical structural components to maintain aircraft safety, and POD helps establish the length of inspection intervals. The established methods for POD will be provided, followed by a discussion of recent statistical research which extends and improves upon these methods.

Experimental Design and Sample Size Considerations in Reliability Studies Using Probability of Detection for Nondestructive Evaluation

Christine Schubert Kabban, Air Force Institute of Technology

Abstract: Measures such as the Probability of Detection (POD) are computed in nondestructive evaluation studies in order to demonstrate the ability to detect defects and inform the maintenance and safety procedures for Air Force aircraft. As a function of the defect size, POD capability for the same component may vary depending on a variety of environmental and design characteristics. However, the ability for a POD study to demonstrate reliable capability across all pertinent environmental and design settings is constrained by the resources required to conduct such comprehensive assessments. Experimental design and, in particular, sample size estimation are vital to this assessment. This presentation discusses important considerations for the experimental design in a nondestructive evaluation study related to sample size requirements. Further, methods to derive exact sample size equations for POD measures using established current and contemporary statistical methods for POD estimation are presented along with comparisons and a demonstrated sensitivity study based on anticipated environmental conditions. The process for estimating sample size requirements is highlighted as a means to bound expected results and to avoid the issues and errors associated with simulation.

Session 3B: JQT Invited Session

Wednesday, October 8, 2:00 – 3:30pm Moderator: Rong Pan

Sugar Land VIII

A scalable algorithm for generating non-uniform space filling designs

Xiankui Yang, Lu Lu & Christine M. Anderson-Cook

Abstract: Traditional space-filling designs have long been popular to achieve uniform spread or coverage throughout the design space for diverse applications. Non-uniform space-filling (NUSF) designs were recently developed to achieve flexible densities of design points to allow users to emphasize and de-emphasize different regions of the input space. However, using a point exchange algorithm, the construction of the NUSF designs entails substantial computational costs, particularly for higher-dimensional scenarios. To improve computing efficiency and scalability, we propose a new algorithm consistent with the fundamentals of NUSF, termed Quick Non-Uniform Space-Filling (QNUSF) designs. By combining hierarchical clustering with group average linkage and strategic point selection methods, the QNUSF algorithm expedites computation. We present two point selection methods, i.e. maximin and minimax QNUSF, to achieve non-uniformity with different emphasis on the spread or coverage of the design characteristic to facilitate broader adaptability. In addition, QNUSF designs allow great flexibility for handling discrete or continuous, regular or irregular input spaces to achieve the desired density distribution and hence improve versatility and applicability for achieving different experimental goals. The computational efficiency and performance of QNUSF designs are illustrated via several examples.

A critique of neutrosophic statistical analysis illustrated with interval data from designed experiments

Abdul Haq, Quaid-i-Azam University and William Woodall, Virginia Tech

Abstract: Recent studies have explored the analysis of data from experimental designs using neutrosophic statistics. These studies have reported neutrosophic bounds on the statistics in analysis of variance tables. In this paper, following Woodall et al. (2025), a simple simulation-based approach is used to demonstrate that the reported neutrosophic bounds on these statistics are either incorrect or too inaccurate to be useful. We explain why the neutrosophic calculations are incorrect using two simple examples.

Session 3C: DOE

Wednesday, October 8, 2:00 – 3:30pm Moderator: Peter Goos

Cane I & II

Large Row-Constrained Supersaturated Designs for High-throughput Screening

Byran Smucker, Henry Ford Health

Abstract: High-throughput screening, in which large numbers of compounds are traditionally studied one-at-a-time in multiwell plates, is widely used across many areas of the biological and chemical sciences including drug discovery. To improve the efficiency of these screens, we propose a new class of supersaturated designs that guide the construction of pools of compounds in each well. Because the size of the pools are typically limited by the particular application, the new designs accommodate this constraint and are part of a larger procedure that we call Constrained Row Screening, or CRowS. We develop an efficient computational procedure to construct CRowS designs, provide some initial lower bounds on the average squared off-diagonal values of their main-effects information matrix, and study the impact of the constraint on design quality. We also show via simulation that CRowS is statistically superior to the traditional one-compound-one-well approach as well as an existing pooling method, and provide results from two separate applications having to do with the search for solutions to antibiotic-resistant bacteria.

Optimizing User Experience in Statistical Tools through Experimental Design

Jacob Rhyne and Mark Bailey, JMP

Abstract: Modern statistical software is increasingly used by users with a wide range of statistical training to address complex real-world problems. However, developers of such software may not always consider assessing its usability. In this talk, we present case studies that assess the usability of statistical software using a design of experiments approach. Topics include user interaction with the software, correct interpretation of results, and accommodating users of varying expertise levels.

Notes

W.J. Youden Address

Wednesday, October 8, 4:00 – 5:00pm Moderator: Jennifer Hellrung

Sugar Land VI

Design of experiments: The Key to the Cause-and-Effect Kingdom

Christopher Nachtsheim, University of Minnesota

Abstract: The design of experiments is the most powerful and efficient method for discovering and characterizing cause-and-effect relationships in real-world phenomena. We begin the presentation by touching on the origins of DOE, its connection to the scientific method, its power, and the limitations of observational studies. We chronicle the rapid growth of DOE applications and highlight key developments in DOE over the past half century. One of the controversies that we have followed closely over the past half century has been the battle between the evangelists of "optimal" design and the evangelists of "classical" design. That controversy, in our view, has been resolved and we will share our views on the nature of that resolution. We close with some discussion of a project that we have been involved in for the past four years involving a textbook for the design and analysis of experiments, and web-based software system that has been developed in support of the text.

Notes

Reception and Poster Session

Wednesday, October 8, 5:00 – 6:00pm

Sugar Land VI

Introducing Continuous Restrictions into Spatial Models via Gaussian Random Fields with Linear Boundary Constraints

Yue Ma, The Ohio State University

Abstract: Boundary constraints are extensively used in physical, environmental and engineering models to restrict smooth states (e.g., temperature fields) to follow known physical laws. Examples include fixed-state or fixed-derivative (insulated) boundaries, and boundaries which relate the state and the derivatives (e.g., convective boundaries). Gaussian random fields (GRFs), as flexible, non-parametric models, are widely applied to recover smooth states from discrete spatial measurements across a domain. We formally define boundary-constrained random fields and introduce a representation-based approach to fully enforce linear boundary constraints on GRFs over multi-dimensional, convex domains. This new class of boundary-constrained random fields can be used for recovering smooth states, with known physical mechanisms working at the domain boundaries. Such constrained random fields make flexible priors for modeling smooth states, enable data-driven discovery of dynamic systems, and improve performance and uncertainty quantification of probabilistic solvers for differential equations.

Scale-Location-Truncated Beta Regression: Expanding Beta Regression to Accommodate 0 and 1

Mingang Kim, Virginia Tech

Abstract: Beta regression is frequently used when the outcome variable y is bounded within a specific interval, transformed to the (0, 1) domain if necessary. However, standard beta regression cannot handle data observed at the boundary values of 0 or 1, as the likelihood function takes on values of either 0 or ∞. To address this issue, we propose the Scale-Location-Truncated (SLT) beta regression model, which extends the beta distribution's domain to the [0, 1] interval. By using scale-location transformation and truncation, SLT beta distribution allows positive finite mass to the boundary values, offering a flexible approach for handling values at 0 and 1.

In this paper, we demonstrate the effectiveness of the SLT beta model in comparison to standard beta regression models and other approaches like the Zero-One Inflated Beta (ZOIB) model [Liu and Kong, 2015] and XBX regression [Kosmidis and Zeileis, 2024]. Using empirical and simulated data, we compare the performance including predictive accuracy of the SLT beta model with other methods, particularly in cases with observed boundary data values for y. The SLT beta model is shown to offer greater flexibility, supporting both linear and nonlinear relationships. Additionally, we implement the SLT beta model within classical and Bayesian frameworks, employing both hierarchical and non-hierarchical models. This comprehensive implementation demonstrates its broad applicability for modeling bounded data in a range of contexts.

Pitfalls and Remedies for Maximum Likelihood Estimation of Gaussian Processes

Ayumi Mutoh, North Carolina State University

Abstract: Gaussian processes (GPs) are nonparametric regression models favored for their nonlinear predictive capabilities, making them popular as surrogate models for computationally expensive computer simulations. Yet, GP performance relies heavily on effective estimation of unknown kernel hyperparameters. Maximum likelihood estimation is the most common tool of choice, but it can be plagued by numerical issues in small data settings. Penalized likelihood methods attempt to overcome likelihood optimization challenges, but their success depends on tuning parameter selection. Common approaches select the penalty weight using leave-one-out cross validation (CV) with root mean squared error (RMSE). Although this method is easy to implement, it is computationally expensive and ignores the uncertainty quantification (UQ) provided by the GP. We propose a novel tuning parameter selection scheme which combines k-fold CV with a score metric that accounts for GP predictive performance and UQ. Additionally, we incorporate a one-standard-error rule to encourage smoother predictive surfaces in the face of limited data, which remedies flat likelihood issues. Our proposed tuning parameter selection for GPs matches the performance of standard MLE when no penalty is warranted, excels in settings where regularization is preferred, and outperforms the benchmark leave-one-out CV with RMSE.

Monitoring Functional Anomalies in a Water Treatment Process

Hunter Privett, Baylor University

Abstract: This research is intended for an intermediate statistical audience, with a focus on functional data analysis, outlier detection applied to process control, and water and wastewater treatment data. Batch processes in water and wastewater treatment (W/WWT) often produce data with a repetitive, functional pattern. Detecting faults in these systems is important both for the quality of the system's effluent water and to prevent system damage. However, the expected nonstationary changes in cyclical behavior over time within these systems and unique treatment process parameters between facilities make fault detection challenging. Some case studies have been done to retroactively assess the efficacy of fault detection in these systems, but case studies are limited in that they rely on assumptions of when a fault may be occurring, rather than a controlled and known fault. In this work, we use recently developed approaches to simulating functional W/WWT datasets in order to compare different process monitoring methods when applied to W/WWT systems for several controlled, simulated faults, and we develop a new real-time monitoring method based on metrics of functional outlyingness. First, a dataset is simulated based using functions from an observed ultrafiltration system for reference, and the functions are contaminated with one of four different types of faults after a period of normal operation. Then, four different fault detection methods are applied, and true positive and false alarm rates are calculated. The first two methods applied are traditional Shewhart charts for each individual measurement using either the original raw values or globally detrended values. The next two methods are based on the functional structure of the data applied to the detrended data. The first method is one that we develop that incorporates metrics of a function's directional outlyingness into a T2 chart. The last method uses a set of T2 and SPE charts based on functional PCA decomposition of the functions. These methods are then compared for four types of faults that include changes to the shape or magnitude of the functions. We demonstrate the importance of accounting for global behavior in W/WWT systems when performing fault detection to increase accuracy. We also demonstrate when a functional based method improves over a traditional method that ignores the functional structure.

Optimal Experimental Designs Robust to Missing Observations

Jace Ritchie, Sandia National Laboratories

Abstract: Modeling and simulation are essential for predicting structural responses across engineering applications. Optimal experimental design (OED) is a useful approach for predicting what experimental design (e.g. sensor placement strategy, input forces, etc.) will result in the most informative data for these models and simulations. One challenge in real-world engineering applications is that sensors can fail, potentially reducing the efficacy of a predicted optimal design. Due to the high cost of experiments and the limited number of sensors that can be placed in a given experiment, it is advantageous to ensure experimental designs are robust to such failures. Existing methodologies to generate such designs either (i) assume probabilities of failure are known or (ii) sample across failure scenarios to understand how sensor failure could affect data acquisition. We expand approach (i) by assuming the distribution of failure probabilities is known, rather than the exact values. With regards to approach (ii), we show that designs for a specific structural dynamics application that are optimized for the loss of one sensor are also robust to the loss of multiple sensors. We apply this approach to cases where sensors experience clipping, meaning the measurements are lost beyond a given sensitivity threshold.

Notes

Technical Program At-A-Glance Schedule: Thursday, October 9

	Sugar Land VII	Sugar Land VIII	Cane I & II
8:00a – 9:30a	**4A: CPID Invited Session** *Predictive Model Monitoring and Assessment in the Lubrizol Q.LIFE® Formulation Optimization System* Anja Zgodic, Lubrizol *A Case Study in Image Analysis for Engine Cleanliness* Quinn Frank, Lubrizol **Moderator:** Annie Booth	**4B: Strategic Design** *The Power of Foldover Designs* Jonathan Stallrich, North Carolina State University *Applications of Weibull Based Parametric Regression for Survival Data* Chad Foster and Sarah Burke, GE Aerospace **Moderator:** Yingfu Li	**4C: Health Applications** *Identifying Prognostic Variables across Multiple Historical Clinical Trials* Xueying Liu, Virginia Tech *Simulation-Based Approach to Designing Analytical Validation Studies to Assess the Stability of Biological Material* Dilsher Dhillon, Freenome **Moderator:** Abdel-Salam G. Abdel-Salam
10:00 – 11:30a	**5A: SPES Invited Session** *Designing Experiments to Identify Optimal Operation Conditions for a Dynamic Cloth Media Primary Wastewater Treatment System* Madison De Boer, Baylor University *Microstructure-based Statistical Tests for Material State Comparison* Simon Mason, The Ohio State University **Moderator:** Oksana Chkrebtii	**5B: Optimal Design** *Optimal Robust Designs with both centered and baseline factors* Xietao Zhou, King's College London *Robust Parameter Designs Constructed from Hadamard Matrices* Yingfu Li, University of Houston - Clear Lake **Moderator:** Xiankui Yang	**5C: QE Invited Session** *Exploratory Image Data Analysis for Quality Improvement Hypothesis Generation* Theodore T. Allen, The Ohio State University *Boundary Peeling: An Outlier Detection Method* Maria L. Weese, Miami University of Ohio **Moderator:** Bill Woodall
11:45 – 1:15p	**Luncheon** *Advancing Science Together: The Quiet Power of Everyday Statisticians* Ji-Hyun Lee, University of Florida Sugar Land VI		
1:30p – 3:00p	**6A: Q&P Invited Session** *Integrating SPC, DOE, and AI/ML for Enhanced Quality and Productivity* Daksha Chokshi, StatQualTech *Using Input-Varying Weights to Determine a Soft Changepoint in Mixture distributions* Di Michelson and Don McCormack, JMP **Moderator:** Lauren Wilson	**6B: Surrogates** *Monotonic Warpings for Additive and Deep Gaussian Processes* Steven D. Barnett, Virginia Tech *Deep Gaussian Processes for Estimation of Failure Probabilities in Complex Systems* Annie S. Booth, Virginia Tech **Moderator:** Yu Ma	**6C: Critical Questions** *Dealing with Sample Bias—Alternative Approaches and the Fundamental Questions They Raise* Frederick W. Faltin, Virginia Tech *Generalization Problems in Machine Learning with Case Studies* Jay Chen, Shell **Moderator:** Sarah Burke
3:15p – 5:15p	**Reception,** followed by **SPES Special Session:** *Digital Twins in Industry and Academia* **Panelists:** Annie S. Booth, Virginia Tech; Wei Chen, Northwestern; Quinn Frank, Lubrizol **Moderator:** Oksana Chkrebtii Sugar Land VI		

Session 4A: CPID Invited Session

Thursday, October 9, 8:00 – 9:30am — Moderator: Annie Booth

Sugar Land VII

Predictive Model Monitoring and Assessment in the Lubrizol Q.LIFE® Formulation Optimization System

Anja Zgodic, Philip Rocco Scinto, Minjee Kim, Kevin Manouchehri; Lubrizol

Abstract: Q.LIFE® is a comprehensive predictive system to solve complex formulation optimization problems. A key piece of this Lubrizol system is its suite of empirical predictive models. Dependent upon the application, prior knowledge, and quality, quantity and nature of the data, models are developed using different modeling techniques from least-squares regression to complex ensemble models. The integration of Q.LIFE® into Lubrizol formulation strategy and practice has necessitated the need for models to be assessed and monitored using control charts, residual checks, and internal algorithms comparing similar formulations. Lubrizol's techniques for model assessment and monitoring as new data is generated, embedded within Q.LIFE®, are demonstrated, as well as some of Lubrizol's ideas and techniques for estimating the error around predictions regardless of the model origin.

A Case Study in Image Analysis for Engine Cleanliness

Quinn Frank, Hongjing Mao, Anja Zgodic; Lubrizol

Abstract: Laboratory Engine Tests are used in the evaluation of engine oil quality and capability. Assessments range from chemical and physical analysis of the used oil after the completion of the test to the rating of test parts for sludge, varnish and deposits. The rating of used parts after a test is complete is typically done by trained raters that look at and examine pistons, rings, liners, and screens in a clean environment with standardized time windows, lighting, rating instructions, and other related criteria. Raters receive both training and calibration credentials in mandatory rating workshops where rater repeatability and reproducibility are measured and assessed. In these workshops, differences in ratings are also compared between actual test parts and digital photographs of test parts. If possible, the use of digitals is much more cost effective in training and assessment due to the elimination of transporting people and test parts around the world. In most cases, however, the ratings are more accurate for the actual test parts than the photographs.

There is a unique opportunity in the rating of Oil Screen Clogging in the 216-hour, Sequence VH Sludge Test for passenger car motor oils. Rater repeatability and reproducibility of both parts and photographs are considered poor. We therefore took the opportunity to conduct a study to generate data and develop a Machine-Learning model and algorithm to rate the digital photographs. Our database consists of ratings by multiple raters on both parts and photographs on an array of clean, dusty, dirty, and completely clogged engine oil screens. Our case study culminates in the comparison of repeatability and reproducibility for the

scenarios of rating actual parts by raters, rating digital photographs by raters, and rating digital photographs using models.

Session 4B: Strategic Design

Thursday, October 9, 8:00 – 9:30am Moderator: Yingfu Li

Sugar Land VIII

The Power of Foldover Designs

Jonathan Stallrich, North Carolina State University

Abstract: The analysis of screening designs is often based on a second-order model with linear main effects, two-factor interactions, and quadratic effects. When the main effect columns are orthogonal to all the second-order terms, a two-stage analysis may be conducted starting with fitting a main effect only model. A popular technique to achieve this orthogonality is to take any design and append its foldover runs. In this talk, we show that this foldover technique is even more powerful than originally thought because it also includes opportunities for unbiased estimation of the variance either by pure error or lack of fit. We find optimal foldover designs for main effect estimation and other designs that balance main effect estimation and model selection for the important factors. A real-life implementation of our new designs involving 8 factors and 20 runs is discussed.

Applications of Weibull-Based Parametric Regression for Survival Data

Chad Foster and Sarah Burke, GE Aerospace

Abstract: Survival analysis is routinely used to characterize the life distribution of a part or system based on a time or usage parameter (e.g., hours, number of cycles, days since manufacture). When the population can be divided into groups, a consistent way is required to address the reliability estimates of these sub-groups that may only be different in damage accumulation rate and not in the failure mechanism. In the aerospace industry for instance, if data is limited to number of flights and the failure was dependent on the length of the flight, the population could be divided into two groups: domestic (short flights) and international (long flights). Separate probability distributions could be fit to each group iterating to ensure a common shape parameter. Alternatively, the shape parameter and the two scale parameters could be fit through a life regression model.

In practice, more complex situations occur. Components of systems are frequently traded, moved, and reused numerous times throughout its life. Reliability estimates are required to inform timing for maintenance activities, part removal, or other field management actions. Life regression models can be useful to manage issues in the field while accounting for these complex populations.

In this presentation, the foundation and background of life regression models using the Weibull distribution is given and supplemented by several examples of field management in the aerospace industry. The method is contrasted with Cox proportional hazard regression which does not require distributional assumptions but also does not provide survival time estimates. It is also highlighted that many real-world applications have

parameter covariance and thus require log-likelihood significance tests. This presentation will guide practitioners on how to use life regression models in actual complex situations.

Session 4C: Health Applications

Thursday, October 9, 8:00 – 9:30am Moderator: Abdel-Salam G. Abdel-Salam

Cane I & II

Identifying Prognostic Variables across Multiple Historical Clinical Trials

Xueying Liu, Virginia Tech

Abstract: In clinical trials, it is critical to incorporate prognostic variables to improve precision for estimating treatment effects. Per FDA guidance, these prognostic variables need to be prospectively specified in the statistical analysis plan. Therefore, there is a great need to effectively identify prognostic variables from historical studies that are similar to the new study. In this work, we propose a multi-task learning approach to identify prognostic variables from multiple related historical clinical trials. Specifically, a bi-level constraint variable selection (Bi-CVS) method is developed to identify both study-specific (within-study) and program-level (cross-study) prognostic variables. In addition, we introduce an efficient algorithm specifically designed for clinical trial settings and investigate its consistency property. The performance of our proposed method is evaluated through simulations for various endpoints, including continuous, binary, and time-to-event. A real clinical application is also presented to illustrate our method.

Simulation-Based Approach to Designing Analytical Validation Studies to Assess the Stability of Biological Material

Dilsher Dhillon, Freenome

Abstract: In vitro medical devices are required to analytically validate key performance attributes in order to provide the Food and Drug Administration (FDA) with objective evidence of the safety and efficacy of the device. These attributes include, but are not limited to, limits of blank, detection, and quantitation, accuracy, imprecision, linearity, and stability. Experimental designs and standards established by the Clinical and Laboratory Standards Institute (CLSI) are preferred by the FDA, to ensure consistency and transparency across medical devices. However, with novel and complex assay designs that did not exist when the relevant CLSI guidelines and associated examples were developed, tailored designs and power calculations may be needed. To illustrate this, we describe a study that evaluates the stability of biological material used for measuring molecular signatures. Currently, there is no standard published by CLSI for evaluating the stability of biological material. However, CLSI EP25Ed2E (Evaluation of Stability of In Vitro Medical Laboratory Test Reagents) provides guidelines on how to establish the stability of reagent materials and recommends using a linear regression of measurement vs. time. The described regression approach assumes that all of the residual variation in the measurements over time is due to measurement error, but this assumption is violated when evaluating the stability of biological material derived from more than one subject, thus impacting design requirements (e.g. sample size (replicates), number of samples and timepoints, and statistical power). In order to account for biological variability, we use linear mixed effects model simulations

to conduct the power analysis. Using knowledge of the measurement error from prior studies and expected levels of variation across subjects, we simulate data from multiple time points. We then vary the slope (the increase or decrease in measurement across time) to estimate the type I and type II error rates, conditional on the number subjects, timepoints and replicates per timepoint. The results of the simulations show that the number of unique subjects and the number of timepoints have the greatest impact on increasing the power to detect a change in the slope. They also help provide guidance on the required number of unique samples as well as the number of time points and replicates per time point. This simulation-based power calculation and analysis still conforms to the recommended design and regression framework outlined in the EP25Ed2E, and it thereby ensures consistency for FDA review. By applying known characteristics of the medical device and the data generating process, simulations provide the ability to modify existing designs to new contexts while still aligning with existing precedent.

Notes

Session 5A: SPES Invited Session

Thursday, October 9, 10:00 – 11:30am Moderator: Oksana Chkrebtii

Sugar Land VII

Designing Experiments to Identify Optimal Operation Conditions for a Dynamic Cloth Media Primary Wastewater Treatment System

Madison De Boer, Baylor University

Abstract: Operation of wastewater treatment (WWT) processes is essential for human health and environmental effects and is highly energy intensive, prompting the need for optimal operation to minimize energy consumption while providing high quality effluent. Our goal is to identify optimal operational setpoints for a primary cloth media filtration system under dynamic influent conditions. Machine learning techniques like reinforcement learning are gaining traction in WWT, but many facilities lack the necessary automation to adopt these advanced methods.

Here, we apply response surface methodology (RSM) paired with constrained optimization as a practical alternative. We target a reduction of effluent total suspended solids (TSS) to enhance effluent primary water quality, reduce backwashes per hour to minimize energy consumption, as well as monitoring tank level changes to account for long-term performance of the filter. RSM is used to identify optimal input settings, maximum tank level, and influent flow rate. The system is tested under various setpoints. Modeling effluent TSS per cycle with a second-order model achieves an R^2 exceeding 75%, demonstrating strong predictive performance.

Under fixed influent flow, optimized setpoints improve filter operation. In varied flow scenarios, the approach enhances TSS removal and long-term filter performance.

Microstructure-based Statistical Tests for Material State Comparison

Simon Mason, The Ohio State University

Abstract: In materials science, material properties and performance are heavily tied to the microstructure of materials, or the myriad features at multiple length scales. The development of new and improved industrially important materials relies upon our ability to meaningfully capture and quantify characteristics of these microstructural features. The natural variation in microstructures across samples of a given material suggests a theoretical probability distribution over these patterns, which may be used for formulating tests of statistical hypotheses. The non-Euclidian structure of these objects, however, prevents the use of standard non-parametric tests of homogeneity such as Kolmogorov-Smirnoff or Cramer-von-Mises. We combine a new approach for metric distribution function-based testing with the development of quantitative descriptors to establish metric distances between microstructure samples. We show that for a materials domain, this test can be used to determine resolvability limits between neighboring material states in terms of processing parameters, differentiating between similar microstructure. We further examine its use as a tool for recognizing/distinguishing deep-learning generated microstructures from physics-generated images.

Session 5B: Optimal Design

Thursday, October 9, 10:00 – 11:30am Moderator: Xiankui Yang

Sugar Land VIII

Optimal Robust Designs with both centered and baseline factors

Xietao Zhou, King's College London

Abstract: Traditional optimal designs are optimal under a pre-specified model. When the final fitted model differs from the pre-specified model, traditional optimal designs may cease to be optimal, and the corresponding parameter estimators may have larger variances. The Q_B criterion has been proposed to offer the capacity to consider hundreds of alternative models that could potentially be useful for data from a multifactor design.

Recently, an alternative parameterization of factorial designs called the baseline parameterization has been considered in the literature. It has been argued that such a parameterization arises naturally if there is a null state of each factor, and the corresponding minimum K-aberration has been explored. In our previous work, we have generalized the Q_B criterion to apply to the baseline parameterization, and it has been shown that the optimal designs found can be projected on more eligible candidate models than the minimal K-aberration design for various specified prior probabilities of main effects and two-factor interactions being in the best model.

In the present work, we have extended the Q_B criterion to the scenario when eligible candidate models contain both baseline and centered parameterization factors. This shall be of interest in practice when some of the factors naturally do have a reasonable null state alongside other factors whose levels are equally important and are more naturally represented under the centered parameterization. We have compared our optimal designs with their counterparts in the most recent literature and have shown that the projection capacity of eligible candidate models/accuracy of estimation of models in terms of the A_s criterion can be improved when the number of runs in the experiment is a multiple of 4 and have also examined and solved the same problem with no restrictions on the number of runs of the experiment so that It could be applied in a more general way in practice.

The basic framework of the Q_B criterion and its variation on baseline parameterization will be briefly discussed, followed by a detailed explanation of the new version dealing with factors under which both parameterizations are present, finished by evaluating the robust and accurate performance of the Q_B optimal designs we have found.

Robust Parameter Designs Constructed from Hadamard Matrices

Yingfu Li, University of Houston – Clear Lake

Abstract: The primary objective of robust parameter design is to identify the optimal settings of control factors in a system to minimize the response variance while achieving an optimal mean response. This article investigates fractional factorial designs constructed from Hadamard matrices of orders 12, 16, and 20 to meet the requirements of robust parameter design. These designs allow for the estimation of critical factorial effects, including all control-by-noise interactions and the main effects of both control and noise factors, while saving experimental runs and often providing better estimation of other potentially important interactions. Top candidates for various combinations of control and noise factors are provided, offering practical choices for efficient and resource-constrained experimental designs with minimal runs.

Session 5C: Quality Engineering Invited Session

Thursday, October 9, 10:00 – 11:30am Moderator: Bill Woodall

Cane I & II

Exploratory Image Data Analysis for Quality Improvement Hypothesis Generation

Theodore T. Allen, The Ohio State University generation
Yifei Zhang, Theodore T. Allen & Ramiro Rodriguez Buno

Abstract: Images can provide critical information for quality engineering. Exploratory image data analysis (EIDA) is proposed here as a special case of EDA (exploratory data analysis) for quality improvement problems with image data. The EIDA method aims to obtain useful information from the image data to identify hypotheses for additional exploration relating to key inputs or outputs. The proposed four steps of EIDA are: (1) image processing, (2) image-derived quantitative data analysis and display, (3) salient feature (pattern) identification, and (4) salient feature (pattern) interpretation. Three examples illustrate the methods for identifying and prioritizing issues for quality improvement, identifying key input variables for future study, identifying outliers, and formulating causal hypotheses.

Boundary Peeling: An Outlier Detection Method

Maria L. Weese, Miami University of Ohio
Sheikh Arafat, Na Sun, Maria L. Weese & Waldyn G. Martinez

Abstract: Unsupervised outlier detection constitutes a crucial phase within data analysis and remains an open area of research. A good outlier detection algorithm should be computationally efficient, robust to tuning parameter selection, and perform consistently well across diverse underlying data distributions. We introduce Boundary Peeling, an unsupervised outlier detection algorithm. Boundary Peeling uses the average signed distance from iteratively peeled, flexible boundaries generated by one-class support vector machines to flag outliers. The method is similar to convex hull peeling but well suited for high-dimensional data and has flexibility to adapt to different distributions. Boundary Peeling has robust hyperparameter

settings and, for increased flexibility, can be cast as an ensemble method. In unimodal and multimodal synthetic data simulations Boundary Peeling outperforms all state of the art methods when no outliers are present while maintaining comparable or superior performance in the presence of outliers. Boundary Peeling performs competitively or better in terms of correct classification, AUC, and processing time using semantically meaningful benchmark datasets.

Notes

Luncheon

Thursday, October 9, 11:45am – 1:15pm ASA SPES Presiding

Sugar Land VI

Advancing Science Together: The Quiet Power of Everyday Statisticians

Ji-Hyun Lee, University of Florida

Abstract: In a world that celebrates exceptionalism, the contributions of everyday professionals often go unnoticed. Funding favors "exceptional" work, but real progress depends on the many, not just the few. In this talk, I challenge the idea that only the extraordinary make a difference. As a biostatistician, collaborator, and team scientist, I'll share how statistical thinking and leadership drive science and patient care. Now, as ASA's 2025 President, I'll further this mission by leading initiatives to strengthen our community, advance our field, and champion the power of everyday statisticians.

Notes

Session 6A: Quality & Productivity Invited Session

Thursday, October 9, 1:30 – 3:00pm Moderator: Lauren Wilson

Sugar Land VII

Integrating SPC, DOE, and AI/ML for Enhanced Quality and Productivity

Daksha Chokshi, StatQualTech

Abstract: In today's competitive landscape, continuous improvement is essential for achieving operational excellence and maintaining a competitive edge. This presentation explores the synergistic integration of Statistical Process Control (SPC), Design of Experiments (DOE), and Artificial Intelligence (AI) to develop a more adaptive and intelligent approach to process optimization and decision-making. SPC establishes a robust framework for monitoring and controlling process variability, ensuring consistent product quality. DOE offers a systematic approach to experimenting with process parameters, identifying optimal conditions that enhance performance. The incorporation of AI/ML further strengthens these traditional methodologies by enabling predictive analytics, anomaly detection, pattern recognition, and automated optimization. By combining these approaches, organizations can transition from reactive quality control to a proactive, data-driven strategy that drives self-learning process improvements.

Several case studies and practical applications will be discussed to illustrate how this triad of methodologies fosters a culture of continuous improvement, empowering organizations to achieve higher levels of productivity, quality, and innovation. The presentation will conclude with an exploration of challenges, implementation strategies, and future directions for AI-driven continuous improvement.

Using Input-Varying Weights to Determine a Soft Changepoint in Mixture Distributions

Di Michelson and Don McCormack, JMP

Abstract: It is quite common for data to come from populations that actually consist of two or more subpopulations. For example, the lifetime distribution of a product may actually consist of multiple distributions depending on specific failure modes. The typical approach in these instances is to use a mixture distribution, where the likelihood of each observation is a weighted combination of several distribution models. These weights may be constant or a function of covariates. Another approach is to consider a changepoint where the distribution model makes a sudden change from one model to another. In this talk, we propose an approach that falls between these two extremes. Instead of a hard changepoint, we instead use a probit or logistic model that allows the mixture proportion to vary over the range of the variable, with the point at which the mixture is evenly split serving as a "soft changepoint". We illustrate this new approach using data from an industrial application.

Session 6B: Surrogates

Thursday, October 9, 1:30 – 3:00pm Moderator: Yu Ma

Sugar Land VIII

Monotonic Warpings for Additive and Deep Gaussian Processes

Steven D. Barnett, Virginia Tech

Abstract: Gaussian processes (GPs) are canonical as surrogates for computer experiments because they enjoy a degree of analytic tractability. But that breaks when the response surface is constrained, say to be monotonic. Here, we provide a mono-GP construction for a single input that is highly efficient even though the calculations are non-analytic. Key ingredients include transformation of a reference process and elliptical slice sampling. We then show how mono-GP may be deployed effectively in two ways. One is additive, extending monotonicity to more inputs; the other is as a prior on injective latent warping variables in a deep Gaussian process for (non-monotonic, multi-input) non-stationary surrogate modeling. We provide illustrative and benchmarking examples throughout, showing that our methods yield improved performance over the state-of-the-art on examples from those two classes of problems.

Deep Gaussian Processes for Estimation of Failure Probabilities in Complex Systems

Annie S. Booth, Virginia Tech

Abstract: We tackle the problem of quantifying failure probabilities for expensive deterministic computer experiments with stochastic inputs. The computational cost of the computer simulation prohibits direct Monte Carlo (MC) and necessitates a statistical surrogate model, turning the problem into a two-stage enterprise (surrogate training followed by probability estimation). Limited evaluation budgets create a design problem: how should expensive evaluations be allocated between and within the training and estimation stages? One may relegate all simulator evaluations to greedily train the surrogate, with failure probabilities then estimated from "surrogate MC". But extended surrogate training offers diminishing returns, and surrogate MC relies too stringently on surrogate accuracy. Alternatively, a surrogate trained on a fraction of the simulation budget may be used to inform importance sampling, but this is data hungry and can provide erroneous results when budgets are limited. Instead we propose a two-stage approach: sequentially training Gaussian process (GP) surrogates through contour location, halting training once learning of the failure probability has plateaued, then employing a "hybrid MC" estimator which combines surrogate predictions in certain regions with true simulator evaluations in uncertain regions. Our unique two-stage design strikes an appropriate balance between exploring and exploiting and outperforms alternatives, including both of the aforementioned approaches, on a variety of benchmark exercises. With these tools, we are able to effectively estimate small failure probabilities with only hundreds of simulator evaluations, showcasing functionality with both shallow and deep GPs, and ultimately deploying our method on an expensive computer experiment of fluid flow around an airfoil.

Session 6C: Critical Questions

Thursday, October 9, 1:30 – 3:00pm Moderator: Sarah Burke

Cane I & II

Dealing with Sample Bias—Alternative Approaches and the Fundamental Questions They Raise

Frederick W. Faltin, Virginia Tech

Abstract: Now and then we hear on the news of some data analysis (generally attributed to "AI"), the outcome of which has gone badly wrong. The root cause is nearly always found to have been some form of sample bias, or its flipside, unintended extrapolation. Awareness of such issues is generally high in the statistical community, but is often very much less so among data scientists more broadly. Statisticians have responded by developing and promoting several very useful lines of research for countering sample bias in observational data. This expository talk presents an overview of some of these approaches, as well as of algorithmic means being developed in other fields to adjust for bias or extrapolation in the process of fitting machine learning models. These alternative approaches raise fundamental questions about what purpose(s) the models being developed are intended to serve, and how our analysis approach needs to adapt to the answer the "right" question.

Generalization Problems in Machine Learning with Case Studies

Jay Chen, Shell

Abstract: Generalization is a critical concern in machine learning, referring to a model's ability to perform well on unseen data. While many models excel on benchmark datasets, their performance often deteriorates in real-world applications due to factors such as data distribution shifts, noise, and overfitting. This presentation offers a technical overview of generalization challenges, examining key contributing factors and mitigation strategies—including feature stationarity. We illustrate these challenges through case studies drawn from real business applications. Our objective is to deepen our understanding of generalization pitfalls and to develop practical approaches that enhance model robustness in real-world deployments.

Notes

Wine & Cheese Reception and SPES Special Session

Thursday, October 9, 3:15 – 5:15pm Moderator: Oksana Chkrebtii

Sugar Land VI

Digital Twins in Industry and Academia

Panelists: Annie S. Booth, Virginia Tech
Wei Chen, Northwestern
Quinn Frank, Lubrizol

Abstract: Digital twins are a new technology that integrates modeling, data collection, and decision-making for a complex system by defining an iterative two-way interaction between the physical agent and its digital representation. Digital twins are currently used in many areas of science and engineering, from manufacturing, to healthcare, to operating autonomous vehicles. While they are considered to be a powerful tool, a unified statistical framework for understanding these diverse systems and quantifying uncertainty from various sources is still a work in progress. This panel discussion will focus on the current applications of digital twins in industry and academia, commonalities and differences in their structures, and primary questions of interest to researchers who are working with these systems.

Notes

Biographies

Abdel-Salam G. Abdel-Salam, Qatar University abdo@qu.edu.qa

Abdel-Salam G. Abdel-Salam is an associate professor in Statistics at the College of Arts and Sciences, Qatar University. Also, He is a Chartered Statistician from the Royal Statistical Society (RSS) in the UK and certified as a Professional Statistician by the American Statistical Association (ASA) in the USA. Dr. Abdel-Salam holds BS and MS (2004) degrees in Statistics from Cairo University and MS (2006), Ph.D. (2009) degrees in Statistics from Virginia Polytechnic Institute and State University (Virginia Tech, USA) and MBA (2023) from Qatar University. He taught at the Faculty of Economics and Political Science (Cairo University), Virginia Tech, and Oklahoma State University. Also, he worked at JPMorgan Chase Co. as an Assistant Vice President in Mortgage Banking and Business Banking Risk Management Sectors. He has published several research papers and delivered numerous talks and workshops nationally and internationally.

Dr. Abdel-Salam has been awarded a couple of the highest prestige awards, such as Teaching Excellence from Virginia Tech, Academic Excellence Award, Freud International Award, and Mary G. Natrella Scholarship from the American Statistical Association (ASA) and American Society for Quality (ASQ), for outstanding graduate study of the theory and application of Quality Control, Quality Assurance, Quality Improvement, and Total Quality Management. In addition, He was awarded the Cairo University Award for International Publication in 2013 and Qatar University's Outstanding Faculty Service Award in 2018. His research interests encompass all aspects of modeling Educational, Psychological, Social, and industrial phenomena, as well as economic capital models. These include statistical process control, multivariate analysis, Regression Analysis, Exploratory and Robust Data Analysis, mixed models, Nonparametric and semiparametric profile monitoring, Health-related monitoring, and prospective public health surveillance.

Theodore Allen, The Ohio State University allen.515@osu.edu

Theodore T. Allen is a Professor in the Department of Integrated Systems Engineering and Courtesy Professor in Computer Science and Engineering at The Ohio State University (OSU). He serves as Associate Director of the Ohio State Institute for Cybersecurity & Digital Trust (ICDT) and as Faculty Director for Industrial Cybersecurity at the Center for Design & Manufacturing Excellence (CDME). Dr. Allen joined OSU in 1996 after completing a full-time internship at Ford Motor Company. He earned his Ph.D. in Industrial and Operations Engineering from the University of Michigan, Ann Arbor, in 1997. His research focuses on the design and analysis of experiments (DOE), including innovations in simulation optimization and metaheuristic techniques. His work has been recognized for both methodological contributions and large-scale practical impact. A 2022 Edelman Academy entry highlighted his

development of a two-color ant colony optimization method for vehicle routing, which enabled DHL to realize $205 million in cost savings and reduce carbon emissions by 140 kilotons. His application of DOE principles and work on combating misinformation are estimated to have influenced approximately 400,000 individuals to receive COVID-19 vaccinations. Dr. Allen has received several honors for his scholarship and leadership, including the USCYBERCOM Cyber Recon 2025 Analyst Group Best Paper Award and the 2024 Honda Partnership Award, reflecting his sustained contributions to both academic research and collaboration with national and industry partners.

Mark Bailey, JMP Mark.Bailey@jmp.com

Mark Bailey has specialized in JMP training and services at SAS Institute for over twenty years and works on user-centric software development in JMP Statistical Discovery. He previously spent fifteen years in R&D at the Eastman Kodak Company and Abbott Laboratories bringing innovative medical diagnostic products to market. He helped cross-functional teams create new products from emerging technology by leading them through the process of customer-driven product development. In particular, he promoted the generation and use of vital business and technical data to support business decisions with applied statistics and methods such as customer research, Quality Function Deployment (QFD), Failure Mode & Effects Analysis (FMEA), Design of Experiments (DOE), and Statistical Process Control (SPC). He also helped lead a quality initiative for an entire division based on the Six Sigma principles of Motorola. He received a doctoral degree in chemistry from the University of Rochester.

Steven D. Barnett, Virginia Tech sdbarnett@vt.edu

Steven Barnett is a PhD candidate in the Department of Statistics at Virginia Tech and will be defending his dissertation later this year. He received his M.S. in Statistics from Virginia Tech in 2022. He received a B.S. in Computer Science from Brigham Young University in 2016 and worked as a software engineer at Qualtrics for four years before beginning his graduate studies. His research focuses on Gaussian process regression, surrogate modeling, and computer model calibration, with applications in the physical and engineering sciences. After graduation, Steven will begin working as a Staff Scientist at Los Alamos National Lab.

Annie Booth, Virginia Tech annie_booth@vt.edu

Annie Booth is an Assistant Professor of Statistics at Virginia Tech. She returned to Virginia Tech this year (having earned her Ph.D. there in 2023), after starting her career in the Department of Statistics at NC State University. Her expertise lies in the design and analysis of computer experiments including uncertainty quantification, active learning, Bayesian optimization, and reliability analysis.

Sarah Burke, GE Aerospace Sarah.Burke@geaerospace.com

Sarah Burke is a Staff Engineer in the Data Science and Applied Statistics team at GE Aerospace. Previously, she spent eight years as a Principal Research Scientist at Linquest Corporation (formerly The Perduco Group) providing statistical support to the Department of Defense and United States Air Force. She earned her Masters in Statistics and Ph.D. in Industrial Engineering from Arizona State University.

Jay Chen, Shell Jay.J.Chen@shell.com

Jay Chen is the Natural Science AI Manager at Shell, with over 15 years of experience in data science and engineering. His expertise spans data acquisition, Monte Carlo simulation, cloud computing, software development, multivariate statistical analysis, and machine learning. At Shell, Dr. Chen is committed to integrating artificial intelligence into the energy industry as part of the company's Shell.ai initiative. He is a member of several professional organizations, including APS, SPE, SEG, and Sigma Xi. Dr. Chen has an extensive publication record, with over 200 articles to his credit.

Wei Chen, Northwestern weichen@northwestern.edu

Wei Chen is a Chair and Professor of Mechanical Engineering at the McCormick School of Engineering at Northwestern. She holds a BS in Mechanical Engineering from Shanghai Jiaotong University, an MS in Mechanical Engineering from the University of Houston, and a PhD in Mechanical Engineering from the Georgia Institute of Technology. Dr. Chen is a member of the American Academy of Arts and Sciences, the National Academy of Engineering, and a fellow of the American Society of Mechanical Engineers.

Ying Chen, KU Leuven ying.chen@kuleuven.be

Ying Chen holds an M.Sc. in Statistics and Data Science and is a doctoral researcher at the Department of Biosystems, KU Leuven, Belgium. Her areas of interest include design of experiments, statistical modeling, and numerical optimization.

Daksha Chokshi, StatQualTech LLC daksha.chokshi@gmail.com

Daksha Chokshi is the Principal Consultant and founder of StatQualTech, LLC, where she collaborates with organizations to drive data-driven transformation and innovation. Her approach combines advanced analytics, quality methodologies, and the latest in AI and machine learning to help teams achieve operational excellence. Daksha has built her reputation through extensive experience leading large-scale initiatives at companies like L3Harris Technologies, Aerojet Rocketdyne, and Pratt & Whitney. As a former Technical Fellow, she has overseen projects spanning Six Sigma, Design of Experiments, Statistical Process Control, and digital transformation, bridging deep technical know-how with hands-on leadership.

Daksha's academic background is equally impressive, holding three master's degrees, in Management of Technology, Industrial Engineering, and Mathematical Statistics. She is also a doctoral candidate in Industrial Engineering. She is an elected Fellow of the American Society for Quality (ASQ) and has held multiple leadership roles within the professional community, including Past Chair of the ASQ Statistics Division and Co- Chair of the ASQ/ASA Fall Technical Conference. She serves on the ASQ Fellows Examining and Standards Committees, acts as the Mentoring Chair for the ASA's Quality & Productivity Section, and contributes to several award and technical program committees.

Daksha's contributions to the field have been recognized through numerous honors, including the Rotary National Award for Space Achievement (RNASA), Distinguished Engineering Project Achievement Awards, the President's Cost Reduction Award, and multiple Mission Success and Eagle Awards. Whether advancing the integration of SPC, DOE, and AI/ML to improve quality, or developing mentoring programs to grow the next generation of talent, Daksha is passionate about building smarter systems and fostering excellence in the professional community.

Madison De Boer, Baylor University Madison_Deboer1@Baylor.edu

Madison De Boer obtained her undergraduate degree in physics and mathematics in 2022 and is currently a PhD candidate at Baylor University in the Department of Statistical Sciences. Her research interests include experimental design, optimization of complex systems, and engineering applications of statistics. She is supported by grants from the Department of Energy to improve water and wastewater treatment.

Dilsher Dhillon, Freenome dhillondilsher@gmail.com

Dilsher Dhillon is a Staff Statistical Scientist at Freenome specializing in designing and validating experimental studies for medical devices. With over 8 years of experience in statistical consulting within multiple organizations, he has mastered the ability to design studies which account for experimental and operational restrictions, while seeking to provide the most optimal designs to answer relevant questions from the experiment. Dilsher is passionate about using statistics to advance knowledge and speed up product development. At this year's conference, he will share insights on design analytical validation studies under the framework recommended by the FDA, while accounting for bespoke and novel medical device nuances. Outside of work, he enjoys spending time with his family and cooking.

Anne Driscoll, Virginia Tech adriscoll@vt.edu

Anne R. Driscoll is a Collegiate Professor in the Department of Statistics at Virginia Tech where she also serves as Director of the Undergraduate Program. She received her PhD in Statistics from Virginia Tech. Her research interests include statistical process control, design of experiments, and statistics education. Anne maintains a connection with statistical practice through her collaboration with NASA. She is an active member of ASQ and ASA, having held many leadership positions in these organizations.

A dedicated and celebrated educator, she has received multiple teaching awards, including the Jesse C. Arnold Award for Excellence in Teaching and Rose Costain Award for Outstanding Departmental Citizenship (2010–2011), as well as the Dr. Carroll B. Shannon Excellence in Teaching Award in 2016. In 2024, Anne received one of the inaugural Jean Dickenson Gibbon's Faculty Fellows Awards for her teaching, leadership, and scholarship in the Department of Statistics.

Fred Faltin, Virginia Tech ffaltin@vt.edu

Over his 40+ year career, **Fred Faltin** has made significant contributions as a researcher, consultant, author, and educator. He has successfully applied statistical quality and productivity methods across many problem domains, and through his publications and presentations, has promoted their use by others. Fred is best known for his work in process control and statistical process monitoring, design of experiments, and as a corporate research manager and international consultant. He was elected a Fellow of ASA in 2002.

Fred was deeply involved in quality and productivity improvement across many of General Electric's businesses and founded the data science laboratory at GE Research. After his career at GE, Fred co-founded a consulting company which supported organizations around the world in domains ranging from manufacturing to financial services, healthcare, and corporate real estate.

Fred has successfully promoted quality and productivity techniques through the publication of technical and non-technical papers and articles in refereed journals, magazines, and book chapters. He was co-Editor-in-Chief of three books in applications of statistics, including the highly cited Encyclopedia of Statistics in Quality and Reliability. Through the many professionals he has trained and mentored in courses, tutorials and seminars, his work has delivered incalculable value to individuals' careers and to the product and process design and improvement of their employers. Fred's ability to translate sophisticated statistical concepts into real-world applications that non-statistical operators and managers could understand and apply has been a key to his impact. Methods that Fred developed and taught are now routinely used by practitioners across the globe as part of their everyday jobs.

Fred currently serves as Professor of Practice in the Department of Statistics at Virginia Tech, where he teaches the theory and practice of Data Science in VT's Computational Modeling and Data Analytics curriculum. In this role, he is promoting awareness and use of statistics for organizational quality and productivity improvement to the next generation of professional data scientists. Fred is a natural teacher whose wealth of personal and business experience greatly benefits his students.
Fred Faltin has demonstrated outstanding and sustained achievement and leadership in developing, promoting, and successfully improving the quality and productivity of products, services, and organizational performance using statistical concepts. He is an exceptionally deserving recipient of the prestigious ASA Gerald J. Hahn Q&P Achievement Award.

Chad Foster, GE Aerospace Chad.Foster@geaerospace.com

Chad Foster is the Chief Consulting Engineer for Data Science and Applied Statistics at GE Aerospace. His specialty is in early-phase product development and design for variation and includes elements of quality, manufacturing, simulation, and optimization. Previously, he led a team at Cummins Inc. developing engines and turbochargers. He received his ScD at MIT in Mechanical Engineering specializing in robust design.

Quinn Frank, Lubrizol gfrank311@gmail.com

Quinn Frank is a Data Scientist for the Lubrizol Corporation, based remotely in Raleigh, NC. He supports statistical modeling and analytics tools for specialty chemical R&D across multiple sectors, from engine oil additives to skin care products. Much of his work involves machine learning applications, especially in the computer vision space, as well as the software/data engineering necessary to facilitate this. He has a BS degree in Mathematics and Computer Science from Georgetown and completed a Master's in Statistical Science at Duke in 2021.

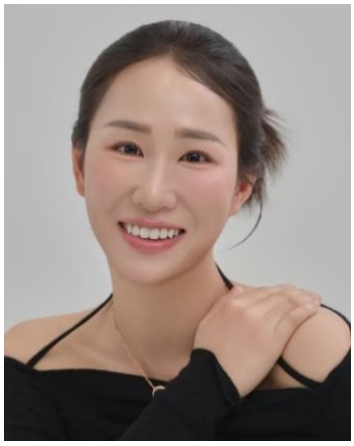
Peter Goos, KU Leuven & University of Antwerp peter.goos@kuleuven.be

Peter Goos is a full professor at the Faculty of Bio-Science Engineering of KU Leuven, and at the Faculty of Business and Economics of the University of Antwerp, where he teaches various introductory and advanced courses on statistics and probability. His main research area is the statistical design and analysis of experiments. Besides numerous influential articles in various kinds of scientific journals, he published the books The Optimal Design of Blocked and Split-Plot Experiments and Optimal Experimental Design: A Case-Study Approach. For his work, Peter Goos has received four Shewell Awards, two Lloyd S. Nelson Awards, a Brumbaugh Award and the Youden Award of the American Society for Quality, the Ziegel Award and the Statistics in Chemistry Award from the American Statistical Association, and the Young Statistician Award of the European Network for Business and Industrial Statistics (ENBIS). Peter Goos is a co-founder of Effex, which brings state-of-the-art design of experiments software to the market.

Mindy Hotchkiss, Enquery Research LLC mindy.hotchkiss@enqueryresearch.com

Mindy Hotchkiss is an independent consultant operating as Enquery Research LLC. She was Technical Specialist and enterprise-wide Subject Matter Expert in Statistics at Aerojet Rocketdyne, now an L3Harris Technologies company. She has over 25 years of experience as a statistical consultant between Pratt & Whitney and Aerojet Rocketdyne, supporting engineering, operations, and technology development across the enterprise, including hypersonics and additive manufacturing, and where she spent many years facilitating complex multi-phase experiments in a wide variety of different physical and virtual environments. She has BS degrees in Mathematics and Statistics and an MBA from the University of Florida, and a Masters of Statistics from North Carolina State University. She is an ASQ CRE, CQE, and CSSBB, and a Past Chair of the ASQ Statistics Division.

Mingang Kim, Virginia Tech kmg0122@vt.edu



Mingang Kim is a Ph.D. candidate in Statistics at Virginia Tech. Her academic research spans statistical modeling for behavioral economics, collaboration with Indivior and the Fralin Biomedical Research Institute to analyze clinical data on opioid craving, studies of breast cancer proton therapy outcomes at the Center for Biostatistics and Health Data Science, and contributions to NSF-funded projects through the Statistical Applications and Innovation Group (SAIG). In industry, she recently served as a data science intern at CVS Health, where she developed segmentation metrics and implemented anomaly detection models.

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Christine E. Knott is a Research Mathematician in the Material State Awareness branch of the U.S. Air Force Research Laboratory's Materials and Manufacturing Directorate (AFRL/RX). She uses statistical models to validate nondestructive inspection systems which are used to find defects in structural and engine components, and her research focusses on Modern Methods for Probability of Detection. She earned her PhD. and M.S. in Applied Mathematics at the Air Force Institute of Technology. Dr. Knott started her federal government career in 2010 at the FAA performing test and evaluation for the ADS-B system, followed by six years as a data analyst at NASIC, and then joined AFRL in 2016. She is a member of the American Society for Nondestructive Testing (ASNT), the American Society for Quality (ASQ) and the American Statistical Association (ASA).

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Ji-Hyun Lee is a Professor of Biostatistics at the University of Florida and Associate Director for Cancer Quantitative Sciences at the UF Health Cancer Center. She provides strategic leadership and promotes collaborative, rigorous research across the center. Ji-Hyun holds master's and doctoral degrees in Biostatistics from UNC Chapel Hill. Her work focuses on clinical trial design, group randomized trials, and best statistical practices. She is a Fellow of the American Statistical Association (ASA) and a certified PStat®. She currently serves the ASA as the 2025 ASA President.

Ryan Lekivetz, JMP Statistical Discovery LLC Ryan.Lekivetz@jmp.com

Ryan Lekivetz is a Director of Advanced Analytics R&D at JMP, heading the Design of Experiments (DOE) and Reliability Development team. Lekivetz earned his doctorate in statistics from Simon Fraser University in Burnaby, British Columbia. He has published papers on DOE topics in peer-reviewed journals and holds many patents that he shares with his team members.

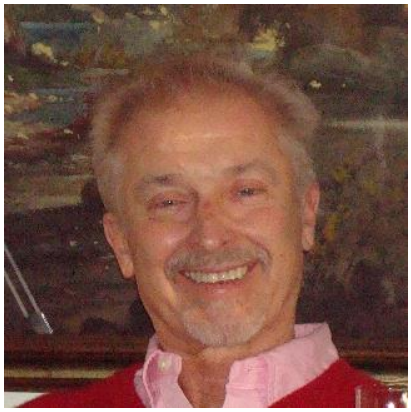
Yingfu Li (Frank), University of Houston – Clear Lake, TX li@uhcl.edu

Yingfu (Frank) Li is an Associate Professor in Statistics in the Department of Mathematics and Statistics at the University of Houston - Clear Lake, TX. He received his Ph.D. in Statistics from the University of Memphis, TN, specializing in non-regular fractional factorial designs. His research interests include experimental designs, survival data analysis, and statistical computing.

Xueying Liu, Virginia Tech Xliu96@vt.edu

Xueying Liu is an an assistant professor in the department of statistical science at Baylor University. Her research interests include multi-task learning, uncertainty quantification, statistical analysis of social network data, and continual learning in AI.

James Lucas, J. M. Lucas and Associates jamesm.lucas@verizon.net

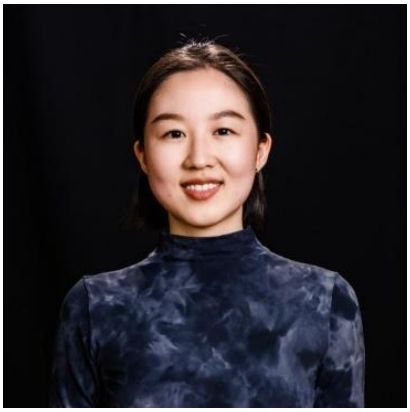


James M. Lucas is the principal at J. M. Lucas and Associates, a consulting firm in Statistics and Quality Management. Before starting his own consulting firm, Lucas was a Senior Consultant at DuPont's Applied Statistics Group for over twenty years. He has a PhD in Statistics from Texas A & M University, a MS in Statistics from Yale University, and a BS in Engineering from The Pennsylvania State University.

He has been an Adjunct Professor at the University of Delaware, and he has directed six PhD dissertations. He is a Fellow of the American Statistical Association (ASA) and of the American Society for Quality (ASQ), an Associate Editor of the Journal of Quality Technology and Quality Engineering.

He has over 70 publications and many are cited frequently. He authored the most cited paper in two volumes of Technometrics and in two volumes of the Journal of Quality Technology. He has won many awards including the 2018 Hunter Award, the Shewhart Medal, the Brumbaugh Award, the H. O. Hartley Award, the Ellis R. Ott Foundation Award, the Don Owen Award, the Shewell Award, and the Youden Prize.

Yu Ma, The Ohio State University ma.2262@osu.edu



Yue Ma is a Ph.D. candidate in Statistics at The Ohio State University. She holds a bachelor's degree in Statistics and Applied Mathematics from the University of California, Berkeley, and a master's degree in Data Science from New York University. Her research focuses on stochastic processes, Bayesian statistics, and uncertainty quantification.

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Simon Mason is an NRC Postdoctoral Associate conducting research at the Naval Research Laboratory in Washington, DC. Simon received his PhD in Materials Science and Engineering from the Ohio State University as a member of the Mesoscale Mechanics and Microstructures research group. His research experience focuses on microstructure quantification and characterization, as well as in analysis of 3-dimensional microstructure datasets from automated serial sectioning and high energy diffraction microscopy.

Don McCormack, JMP Statistical Discovery LLC Don.McCormack@jmp.com

Don McCormack is a is a Technical Enablement Engineer at the JMP division of SAS Institute. He has been a applied statistician for over 30 years with experience in both the Semiconductor and Biotechnology industries. McCormack holds a B.S. degree from Rensselaer Polytechnic Institute and Master's degrees in Education and Statistics from the University of Texas at Austin. He is a member of the American Statistical Association and a Senior Member of the American Society for Quality.

Di Michelson, JMP Statistical Discovery LLC di.michelson@jmp.com

Di Michelson received a Ph.D. in Statistics in 1994 from Texas A&M University. She started her career as an industrial statistician in the semiconductor industry and now has the job of her dreams, teaching engineers and scientists how to get information out of their data using her favorite software. Her research interests include statistical process control and design of experiments, especially when the data are auto-correlated and factors are random.

Ayumi Mutoh, North Carolina State University amutoh@ncsu.edu

Ayumi Mutoh is a PhD student in the Department of Statistics at North Carolina State University. She received her B.S. in statistics at University of Cincinnati.

Christopher Nachtsheim, University of Minnesota nacht001@umn.edu

Christopher J. Nachtsheim is Professor and Frank A. Donaldson Chair of Operations Management in the Supply Chain and Operations Department of the Carlson School of Management at the University of Minnesota. Dr. Nachtsheim received his Ph.D. in Operations Research from the University of Minnesota, served as staff member in the Statistics Group at Los Alamos National Laboratory from 1978-1981, and as Senior Statistician at General Mills from 1982-1984. In 1984 he joined the University, serving as Chair in the Department of Operations and Management Science (now Supply Chain and Operations) from 1993-1996 and from 2002-2014, and as Associate Dean of Faculty and Research from 1996-2000.

Dr. Nachtsheim's teaching and research interests center on statistics and business analytics, optimal design of industrial product and process improvement experiments, regression and predictive analytics, and quality management. In addition to his regular teaching duties at the University of Minnesota, Dr. Nachtsheim conducts workshops regularly for industry and has taught business statistics at the Warsaw School of Economics, the Vienna School of Business and Economics, and Lingnan College at Sun Yet Sen University regularly since 1993. Among his major publications are two texts: Applied Linear Statistical Models, 5th Edition, 2005, Richard D. Irwin, and Applied Linear Regression Models, 4th Edition, 2004, Richard D. Irwin (both with John Neter, Michael Kutner, and William Li). He is co- discoverer, along with Brad Jones (SAS Institute) of Definitive Screening Designs, and is the co-inventor of the coordinate exchange algorithm for constructing exact optimal experimental designs.

Dr. Nachtsheim is the recipient of the Teacher of the Year Award for the Vienna Executive MBA program in 2017 and 2019, and the Curtis Cup Award for CEMBA Faculty of the Year in the Carlson Executive MBA program in 2018 and 2019. Dr. Nachtsheim has published over 80 articles in the statistics literature and has served as associate editor for many of the top journals in his field, including Journal of the American Statistical Association, Technometrics, Journal of Quality Technology, Statistics and Computing, and the Journal of Statistical Computation & Simulation. He currently serves on the editorial board for the Journal of Quality Technology. He served as Examiner, Malcolm Baldrige National Quality Award in 1996. He is a four-time recipient (1991, 2009, 2011, and 2014) of the Brumbaugh Award of the ASQ for best paper published in the area of industrial quality control, two-time recipient of the Lloyd S. Nelson Award of the ASQ for the published paper having the greatest impact on practitioners (2010 and 2012), a three-time recipient of the Jack Youden Prize for the best expository paper published

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Samantha-Anne Horwitch Nadolny is a career accomplished corporate lawyer, compliance professional and Human Resources leader with a demonstrated history in multiple industries, including manufacturing, construction, energy, and oil and gas. While currently the Vice President and General Counsel of Primary Arms, LLC, she has worked for companies like Sterling Infrastructure (NYSE: STRL), Citelum-an EDF Groupe company, and Select Water Solutions (NTSE: WTTR), all of which have made her a valuable advisor of the law for the business, providing expertise in all aspects of corporate legal guidance, strategic business support, domestic and international regulatory compliance, and risk mitigation.

Outside of the office, Samantha-Anne is a dedicated philanthropist and heavily involved in her community. Inside the legal industry, she serves as the Chairman Emeritus of the Board of Trustees for the Houston Young Lawyers Foundation, on the board of the Houston Bar Association, and as a Trustee of the Texas Bar Foundation. Out in the community, she takes pride in serving on the Houston Symphony League Board, the John Cooper School Alumni Board, and for the American Cancer Society Cattle Baron's Ball and Shuck Cancer Initiatives. This year she was recognized by the American Cancer Society as "Cattle Barons Ball Rookie of the Year" and also as a Shuck Cancer Pearl Honoree for her efforts in medical philanthropy. Her true passion in

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Samantha-Anne graduated from the John Cooper School in the Woodlands, Texas before attending Fairleigh Dickinson University in Madison, New Jersey, where she was a dual sport NCAA athlete. She earned her law degree at Samford University Cumberland School of Law and is licensed in the State of Texas. She lives with her husband, Robert, in the Historical Heights area of Houston. When she is not involved in philanthropic efforts, Samantha-Anne enjoys cooking, collecting wine, and running a fashion blog.

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Jace Ritchie is pursuing a PhD in Statistics and Data Science from Utah State University's Department of Mathematics and Statistics. He received his B.S and M.S. from Brigham Young University in 2023. His main research focus lies in design of experiments, focusing on improving small response surface designs via metaheuristic optimizers, designing experiments that are robust to missing observations, and multi-objective optimal design. He has also explored techniques for automobile crash hotspot identification, assurance testing for reliability, and human interpretation of multi-label model outputs. He is currently an intern for Sandia National Laboratories.

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Christine Schubert Kabban received the B.S. degree in Mathematics from the University of Dayton, M.S. in Applied Statistics from Wright State University and a PhD in Applied Mathematics from the Air Force Institute of Technology (AFIT). She has been researching and practicing statistics for over 20 years in clinical, engineering, and statistical fields and is currently a Professor of Statistics in the Department of Mathematics and Statistics in the Graduate School of Engineering and Management at AFIT. Her current work focuses in applications to structural health monitoring, reliability, target detection, classification methods, and autonomous systems and networks with hierarchical and complex multi-dimensional data in addition to natural language processing.

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Byran Smucker is a Senior Scientist at Henry Ford Health in the Department of Public Health Sciences, Division of Biostatistics. Before joining Henry Ford, Dr. Smucker was a faculty member at Miami University in Oxford, OH from 2010-2024. He received his PhD in Statistics and Operations Research at The Pennsylvania State University in 2010 under the direction of Enrique del Castillo and James Rosenberger. Dr. Smucker studies and supports the design and analysis of experiments, particularly in the context of biomedical research. His statistical research has focused largely on both the construction and analysis of screening designs, but also on response surface methods and robust designs. In addition, he has published in applied optimization, predictive modeling, statistical pedagogy, and data privacy.

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Jon Stallrich is an Associate Professor in the Department of Statistics at North Carolina State University. He earned his Ph.D. in Statistics from Virginia Tech in 2014. His research interests include design and analysis of screening experiments, computer experiments, online controlled experiments, functional data analysis, and variable selection. He has served in multiple leadership roles for the American Statistical Association, including member of the Committee for Applied Statisticians, Program Chair and Chair for SPES, and General Conference Chair for the 2024 Fall Technical Conference.

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After a 20-year industry career, **Jennifer Van Mullekom** joined Virginia Tech in 2016. She is Associate Director of the Academy of Data Science, Graduate Director of the MS in Data Science program, and a Professor of Practice in Statistics. She is currently developing a professional graduate degree for working adults and remains active in the global statistical practice community.

Previously, she was a Senior Consulting Statistician and Certified Six Sigma Master Black Belt at DuPont, where her leadership on the Tyvek® Medical Packaging Transition Project earned a DuPont Engineering Excellence Award. She continues to collaborate with DuPont to maintain her industry connections.

Jen holds leadership role in the ASA and ASQ, is an inventor on two U.S. patents, and has also worked at Lubrizol and Capital One. She frequently presents on communication, collaboration, leadership, and ethics topics at conferences. In 2024, she received the ASA's Section on Statistical Consulting Mentoring Award, and in 2025 was elected a Fellow of the ASA. She earned her PhD and MS in Statistics from Virginia Tech and dual bachelor's degrees in Mathematics and Mathematics Education from Concord University.

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Scott Vander Wiel is a fellow of the American Statistical Association, conducting research at Los Alamos National Laboratory since 2005 and previously at Bell Laboratories since 1991. He leads collaborations with scientists and engineers to solve strategic problems at the core mission of the Weapons Complex. His work routinely shapes the Laboratory's understanding of performance and aging, certification methods, and annual reporting on the condition of the Nation's stockpile.

Scott analyzes data and develops statistical methods for problems in diverse areas such as weapon physics simulations, turbulence, atomic nuclear data, material microstructure, nuclear forensics, Doppler velocimetry, thermodynamic equations of state, radio astronomy, malware detection, power grid uncertainty, and weapon response safety. He holds patents on methods for network traffic modeling and for incremental quantile estimation. His Ph.D. is in Statistics from Iowa State University.

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William H. Woodall is an Emeritus Professor with the Department of Statistics, Virginia Tech. He is a former Editor of the Journal of Quality Technology (2001–2003) and the current Editor of Quality Engineering (2025–2027). He was a recipient of the ENBIS Box Medal in 2012, ASQ Shewhart Medal in 2002, William G. Hunter Award in 2019, Youden Prize in 1995 and 2003, Brumbaugh Award in 2000 and 2006, Soren € Bisgaard Award in 2012, Lloyd S. Nelson Award in 2014, Ellis Ott Foundation Award in 1987, and the Best Paper Award for IIE Transactions on Quality and Reliability Engineering in 1997. He is a Fellow of the American Statistical Association, a Fellow of the American Society for Quality, and an Elected Member of the International Statistical Institute.

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Anja Zgodic is a Research Data Scientist in the Data Science and Statistics Department at The Lubrizol Corporation, where she works on interesting applications and new methodologies for various types of data. Prior to joining Lubrizol in 2023, Anja received her PhD in Biostatistics from the University of South Carolina. She also holds a certificate in Strategic Innovation from the Darla Moore School of Business, a MS from Brown University, and a BA from Providence College. Between her undergraduate and graduate studies, Anja worked in industry as a data scientist in a startup company and in a large pharmaceutical corporation. Anja's research at Lubrizol focuses on

methods for high-dimensional data, multivariate statistics, Bayesian approaches, effective computation, and optimization.

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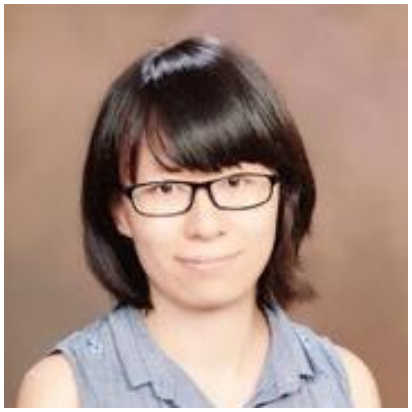

Qiong Zhang is an Associate Professor of Statistics at Clemson University. She received PhD in statistics from University of Wisconsin Madison in 2014. Her research interests include the interface between information collection and statistical modeling, experimental design, modeling, and uncertainty quantification for computer experiments, statistical design for web experiments, and data analytics for engineering applications.

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Xietao Zhou is currently a postgraduate researcher at King's College London and his current research interest lies in obtaining optimal designs under model uncertainty. Prior to this, his has obtained a Bachelor's degree in Mathematics, management and finance (2020) and a Master's degree in Complex systems modeling (2021) from the same university.

Call for Abstracts

68th Annual Fall Technical Conference

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October 6-8, 2026

DoubleTree Suites by Hilton – Charlotte Southpark, Charlotte, North Carolina

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Please submit an abstract online if you are interested in presenting a paper or poster in any of the categories of: Statistics, Quality, Experimental Design, Machine Learning, or Tutorial/Case Studies. The work in a presentation/poster should be strongly justified by an application to a problem in engineering, manufacturing, the process/chemical industry, the physical sciences, or a service industry. The mathematical level of the papers/posters may range from introductory to advanced (e.g., that of the *Journal of Quality Technology* or *Technometrics*). The program committee welcomes suggestions for special session topics or speakers. If you have any suggestions, please contact one of the program committee members listed below. For more information, visit http://www.falltechnicalconference.org

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Abstract Content
Abstract submissions should include a modality, session preference, and target audience (choose one option for each) and the following three components:

1. Motivation or background
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Modality
___ Presentation
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Session Preference
___ Statistics
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Target Audience
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