60TH ANNUAL FALL TECHNICAL CONFERENCE

STATISTICS AND QUALITY:

TWIN PILLARS OF EXCELLENCE

October 6-7, 2016 • Minneapolis, Minnesota
Courtyard Minneapolis Downtown by Marriott

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60th Annual Fall Technical Conference

Statistics & Quality: Twin Pillars of Excellence

Dear Attendee,

Welcome to Minneapolis! It is my pleasure to welcome you to the 2016 ASQ/ASA Fall Technical Conference in the Twin Cities of Minnesota!

The FTC brings together researchers and practitioners from academia, industry and government to discuss the more effective use of statistical methods for research, innovation and quality improvement. The conference is co-sponsored by the American Society of Quality (Chemical & Process Industries Division and the Statistics Division) and the American Statistical Association (Section on Physical and Engineering Sciences and Section on Quality and Productivity).

The conference theme, "Statistics and Quality: Twin Pillars of Excellence", reflects the importance of using data to drive quality improvements and enhance innovative solutions to achieve excellence. This year the technical program committee under the leadership of John Szarka, with representatives from each of the ASA and ASQ sections, has put together an outstanding group of sessions including topics in design of experiments, reliability, statistical process control, measurement systems analysis, Bayesian theory, and others. The program also includes a SPES special session that starts with a Wine & Cheese Reception, followed by: ***Leadership Perspectives: A Multi-Faceted Panel Discussion***. The technical program complements the excellent short courses offered on Wednesday, October 5.

The keynote opening Plenary Session and the Youden Memorial Address are among the high points of the FTC. This year I am honored to introduce Dr. Lynne Hare, Statistical Strategies, as the 2016 FTC plenary speaker; and Dr. Joanne Wendelberger, Los Alamos National Laboratory as the Youden Memorial Address speaker. It is also my privilege to introduce the invited luncheon speakers: Dr. Jessica Utts, ASA President; and Dr. Douglas Montgomery, Arizona State University.

Special thanks go to: the FTC Steering Committee for their support; the Technical Program committee lead by John Szarka; the Short Course committee lead by Yongtao Cao; Ashley Childress as FTC Treasurer, Jin Xia as Exhibitor Chair, and Maria Weese for Publicity. Thanks also to Rachel Pollack, Stat-Ease, for her never-ending assistance and creation of the conference program and signage. Many thanks to Flor Castillo's guidance as the previous FTC chair.

Enjoy the great presentations and networking opportunities. Please join us in the Hospitality Suite Wednesday and Thursday nights 8:30 – 11:00pm.

Sincerely,

Shari Kraber

2016 FTC General Conference Chair

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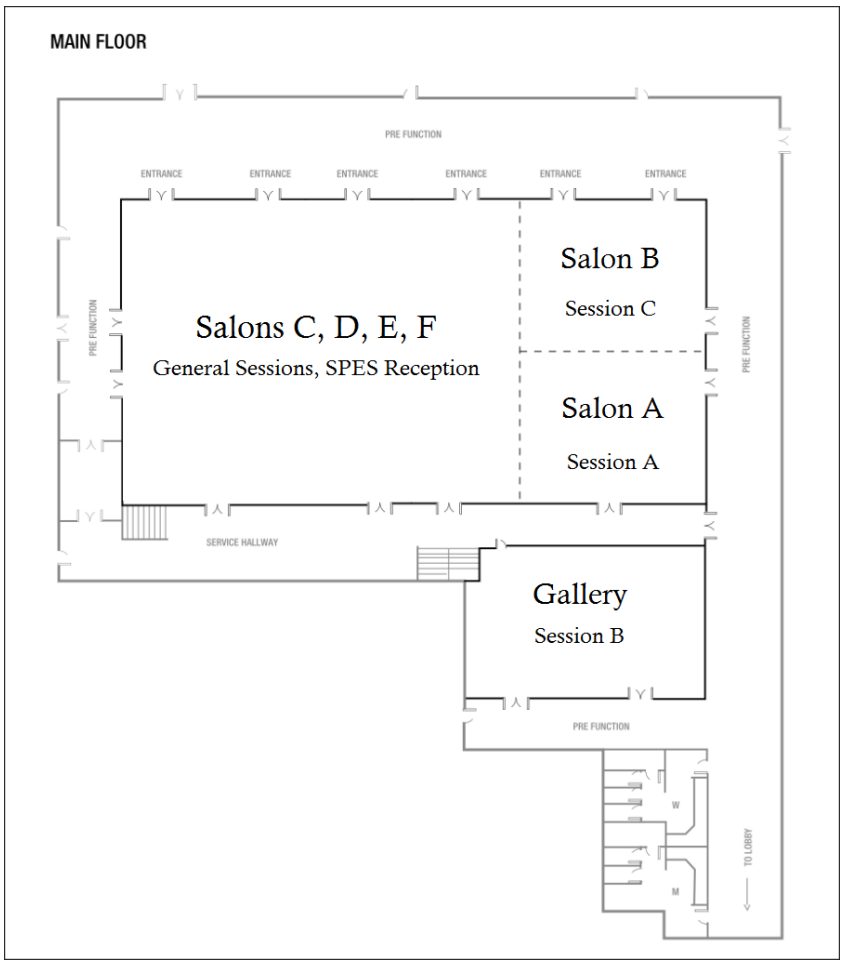

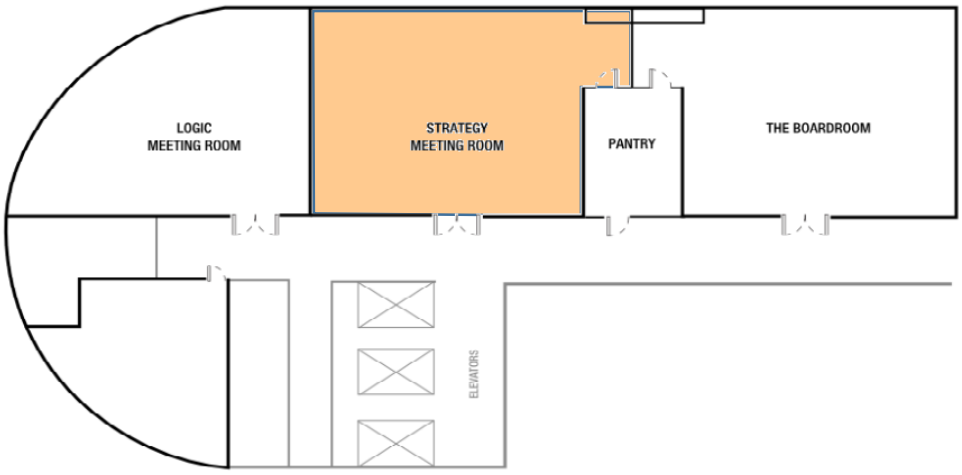

Supplemental Event Locations

Wednesday, Oct 5	6:00 - 8:00pm	CPID Business Meeting – Hospitality Suite
Wed-Thur, Oct 5-6	8:30 – 11:00pm	Hospitality Suite
Thur-Fri, Oct 6-7	7:00 – 8:00am	Speaker Breakfast – Strategy Room (3rd floor)
Thursday, Oct 6	5:15 – 6:15pm	QE Board Mtg – Strategy Room (3rd floor)
Saturday, Oct 8	7:00am – 1:30pm	ASQ Certification Testing – Gallery
Saturday, Oct 8	8:00am – 5:00pm	Statistics Division Board Mtg – Strategy (3rd floor)

Special Thanks

Thanks to Adsurgo, LLC for sponsoring the Hospitality Suite! Join us Wednesday and Thursday evenings 8:30 – 11:00pm.

Thanks to Stat-Ease, Inc. for sponsoring the Fall Technical Conference by providing the conference programs, short course notes, and other printed materials.

Exhibitors

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60th Annual Fall Technical Conference

Statistics & Quality: Twin Pillars of Excellence

At-a-Glance Schedule - Thursday, October 6

	Salon CDEF		
8:00a – 9:00a	**Welcome & Plenary Session** *Hahn Space*, Lynne Hare, Statistical Strategies		
	Salon A	Gallery	Salon B
9:15a – 10:00a	**1A**: ***The Art & Science of Effective Statistical Collaboration*** Peter Parker, NASA **Moderator:** Christine Anderson Cook	**1B:** ***A Meta-Analysis of Response Surface Studies*** Byran Smucker, Miami Univ. **Moderator:** Maria Weese	**1C:** ***Estimating the Distribution of the Peak Pressure Exerted on a Scale Model of a Structure in a Wind Tunnel*** Adam Pintar, NIST **Moderator:** Brooke Marshall
10:30a – 12:00p	**2A: STAT Invited Session** *Design for Physical Models* Brad Jones, SAS *Dimensional Data Analysis* Dennis Lin, Penn State Univ. **Moderator:** Teri Utlaut	**2B: Sequential Experimentation** *Novel Approaches in Designing Computer Experiments with Inert Factors* Shan Ba, Procter & Gamble Co. *Augmenting Definitive Screening Designs for Estimating Full Quadratic Models,* Abigael Nachtsheim, Arizona State Univ. **Moderator:** David Edwards	**2C: Technometrics Invited Session** *Estimating a Parametric Component Lifetime Distribution* Bill Meeker, Iowa State Univ. *A Multi-Level Trend-Renewal Process for Modeling Systems with Recurrence Data* Yili Hong, Virginia Tech **Moderator:** Ron Fricker
	Salon CDEF		
12:15p – 1:45p	**Luncheon**: *Remembering Connie Borror*, Douglas Montgomery, ASU		
	Salon A	Gallery	Salon B
2:00p – 3:30p	**3A: Statistical Process Control** *Application of Multivariate Process Control Technique* Steven Cox, Rotary Power Ltd. *Recommendations for Application of the k-chart* Maria Weese, Miami Univ. **Moderator:** Anne Driscoll	**3B: Optimal DOE** *Properties of Optimal Designs for Dual Response Systems* Sarah Burke, ASU *DP-Optimality as a Multiple Criterion* Shaun Wulff, Univ. of Wyoming **Moderator:** Peter Goos	**3C: Industrial Applications** *Industrial Application of the Expanded Gage R&R Study* Louis Johnson, SnapDat, Inc *Attribute MSA: Making the Most of your Binary Response* Thomas Rust, Autoliv **Moderator:** Jon Lindenauer
	Salon CDEF		
4:00p – 5:00p	**W. J. Youden Address** *Understanding Today's Complex World* Joanne R. Wendelberger, Los Alamos National Laboratory		

At-a-Glance Schedule - Friday, October 7

	Salon A	Gallery	Salon B
8:00a – 9:30a	**4A: Q & P Invited Session** *Monitoring and Improving Quality via Consumer Comments* Alex Gutman, P&G Co. *Statistical Methods for Data Science* Joanne Wendelberger, Los Alamos National Laboratory **Moderator:** Byran Smucker	**4B: CPID Invited Session** *Case Studies: There are No Answers in the Back of the Book* Jennifer Van Mullekom, DuPont *Analysis of a Functional Response from a Mixture Experiment* Mona Khoddam, Arizona State University **Moderator:** Ashley Childress	**4C: Journal of Quality Technology Invited Session** *Nonparametric CUSUM Control Charts* Daniel Jeske, UC Riverside *Residuals-Based CUSUM Charts* Murat Caner Testik, Hacettepe University **Moderator:** Duane Allen
10:00a – 11:30a	**5A: SPES Invited Session** *A Bayesian Alternative to the Sequential Probability Ratio Test for Attribute Sampling* Robert Noble, Teva Pharmaceuticals *Resolving Conflict with Bayes and Statistical Engineering* Greg Steeno, Pfizer Inc. **Moderator:** Brad Evans	**5B: Screening Experiments** *Considerations for Screening Experiments with Partial Replication* David Edwards, Virginia Commonwealth Univ. *Screening Experiments involving Two Crossed Blocking Factors* Peter Goos, KU Leuven **Moderator:** Flor Castillo	**5C: Quality Engineering Invited Session** *Improving Reliability Understanding* Christine Anderson-Cook, Los Alamos National Laboratory *Statisticians as Innovation Leaders* Kymm Hockman, DuPont **Moderator:** Adam Pintar
	Salon CDEF		
11:45a-1:15p	**Luncheon**: *Communicating the Value of What Statisticians Do,* Jessica Utts, ASA President		
	Salon A	Gallery	Salon B
1:30p – 3:00p	**6A: Inspection Validation** *Use of Acceptance Sampling Plans in the Validation of Inspection Methods* Mark Balhorn, Boston Scientific *Assessing Inspection Tool Performances through Capture Rate* Dario Nappa, Qorvo Inc **Moderator:** Thomas Rust	**6B: Applications in DOE** *Restricted-Randomization Optimal DOE Combining Mixture & Non-Mixture Factors* Martin Bezener, Stat-Ease, Inc. *Order-of-Addition Experiments* Joseph Voelkel, Rochester Institute of Technology **Moderator:** Greg Piepel	**6C: Case Studies & Applications** *Pulp Machine Sheet Break Reduction* Jon Lindenauer, Weyerhaeuser Company *Decision Trees for Mechanical System Root Cause Investigation* Chad Foster, GE Aviation **Moderator:** Jennifer Kensler
	Salon CDEF		
3:15p – 5:15p	**Wine & Cheese Reception,** followed by **SPES Special Session:** *Leadership Perspectives: A Multifaceted Panel Discussion* with *Christine Anderson-Cook, Ron Fricker, Jessica Utts, and Kevin White* **Moderator:** Anne Driscoll		

Welcome & Plenary Session
Thursday, October 6, 8:00 – 9:00 AM
Salon CDEF

Hahn Space

Lynne B. Hare
Statistical Strategies

Abstract: Hahn Space cannot be found in an astronomer's guide, or in the imagination of the mathematician. Rather, it is the domain of the applied statistician as pioneered by Gerry Hahn and other great statistical leaders. Gerry exemplifies the industrial statistician for whom success requires strong communication skill, a sense of humor, grounding in statistical theory, an ability to learn clients' technology quickly, and sound judgement of business needs and financial constraints.

These must be accompanied by a strategic plan for culture change – a culture of data-driven decisions supported by an all-on-one-team attitude and open mindedness across the organizational spectrum.

Examples presented in this talk include those from R&D and Q&P applications as well as those that bridge the gap between them. The success of these endeavors, measured by financial experts, has amounted of hundreds of millions of dollars in savings.

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Notes

Session 1A Moderator: Christine Anderson-Cook
Thursday, October 6, 9:15-10:00 AM
Salon A

The Art and Science of Effective Statistical Collaboration

Peter A. Parker
National Aeronautics and Space Administration

Abstract: For statisticians to achieve significant organizational impact, simply possessing a mastery of statistical methodology is necessary, but not sufficient. Earning an opportunity to demonstrate the power of statistical thinking and methods requires a practitioner to be recognized as a collaborator. Collaboration differs from consultation in the individual's own view of their team contribution and in the team's recognition of them as a colleague instead of a passive supporting member. For many statisticians, deliberately improving their collaboration skills may be the most challenging aspect of their career, since it requires instruction and mentoring that are often lacking in their academic training and work experiences. In this talk, strategies are presented to become a more effective statistical collaborator based on theory from organizational psychology and extensive statistical collaboration experience. Collaboration techniques are illustrated and emphasized through statistical practice vignettes. Effective collaboration is personally rewarding, and it is often the key element in developing innovative solutions that produce high organizational impact.

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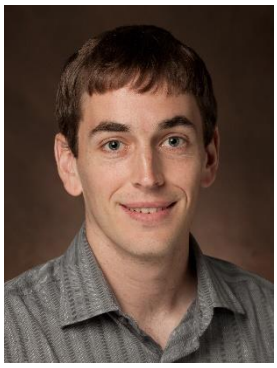
Notes

Session 1B
Thursday, October 6, 9:15-10:00 AM
Gallery

Moderator: Maria Weese

A Meta-Analysis of Response Surface Studies

Byran Smucker
Miami University



Abstract: In the last twenty years, thousands of response surface studies have been published. Using the Web of Science Application Program Interface, we extract over 20,000 records of journal articles from all Science Citation Index disciplines over the last two decades. These articles appeared to contain published central composite and Box-Behnken designs, and we secured a random sample of more than 100, stratified by the number of factors, and obtained the design, information about factors, and other characteristics of the experiments. These designs are then reanalyzed and the results gathered together in a meta-analysis to reveal information about effect heredity, hierarchy, and sparsity. We empirically quantify these principles to guide researchers toward more realistic simulation scenarios and more efficient designs, and provide evidence for what practitioners have informally observed.

Additional Authors: Rebecca Ockuly, Le Chang, Maria Weese, Miami University; David Edwards, Virginia Commonwealth University.

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Notes

Session 1C
Thursday, October 6, 9:15-10:00 AM
Salon B

Moderator: Brooke Marshall

Estimating the Distribution of the Peak Pressure Exerted on a Scale Model of a Structure in a Wind Tunnel

Adam L. Pintar
NIST

Abstract: Wind pressures used in structural design are measured, e.g., at 500 observations per second in wind tunnel tests on scale models equipped with pressure sensors at critical locations. Due to the random nature of wind, repeated experiments of course yield different pressure extrema, positive pressure or negative suction. The goal of these experiments is to estimate the distribution of the extrema. Furthermore, in transforming the results to full scale for regions exposed to different wind speeds, similitude laws often require extrapolation of the test results to durations longer than the actual test.

Engineers have traditionally solved this problem by partitioning the history of pressures into n parts and fitting a Gumbel distribution to the n maxima, one from each part (first taking negatives if focusing on suction). The fitted Gumbel distribution can then be used to estimate the distribution of the maximum of, e.g., $1.67n$ observations if the desired duration is 1.67 times that of the actual test. The answer depends, unsatisfyingly, on n.

We have developed and investigated a different approach that uses a peaks over threshold model instead of a classical extreme value model. A commonly cited advantage of peaks over threshold models are their ability to use more data than classical extreme value models, reducing uncertainty in parameter estimation. However a difficulty has historically been choosing an appropriate threshold, which is basically equivalent to choosing the number of partitions, n, for classical extreme value models. We have solved this problem by selecting the threshold that optimizes a criterion measuring the fit of the model to the data.

After fitting the peaks over threshold model to the observed pressures, the distribution of the peak is constructed by Monte Carlo simulation. Uncertainty in the estimated distribution of the peak is quantified by a bootstrap algorithm. Since the approach is computationally daunting, an R package (publicly available but not on CRAN) has been written especially for it. The presentation will cover the classical approach, the new approach, their differences, and carrying out our approach in practice using the R package.

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Notes

Session 2A: STAT Invited Session Moderator: Theresa Utlaut
Thursday, October 6, 10:30 AM – 12:00 PM
Salon A

Design for Physical Models

Brad Jones
SAS

Abstract: An assumption behind factorial design of experiments is that a low order empirical approximation is adequate to model the response of interest. For some experiments, however, there is substantial physical knowledge about the system. This knowledge may be imbedded in a computer simulation model or an analytic expression with some unknown constants. To maximize the information in the design it is necessary to incorporate this physical knowledge into the choice of factor level combinations for the design. This session will provide methods for generating designs for such experiments.

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Notes

Session 2A: STAT Invited Session Moderator: Theresa Utlaut
Thursday, October 6, 10:30 AM – 12:00 PM
Salon A

Dimensional Data Analysis

Dennis Lin
Pennsylvania State University

Abstract: The design and analysis techniques tailored for computer experiments have been largely developed. Space-filling designs such as Latin hypercube designs (LHDs) are commonly used, especially in the context of implementing Gaussian Process models to emulate the experimental results. However, the factor space, where the designs are filled into and analyses are performed on, has not been well explored. In this paper, we incorporate dimensional analysis (DA) in determining the factor space and propose the "dimensional analysis based factor space" (DA factor space) on which designs and analyses should be performed. When using DA factors, several advantages can be achieved: (a) reduction of variable dimension and efficiency is increased, (b) efficient estimations, (c) interpretability of variable effects and resulting models, (d) robustness and consistency and (e) feasible and costless for most computer experiments. As will be shown, such a DA approach is rather general. Furthermore, Conditional Latin Hypercube Design is proposed. Such a design is particularly good in dealing with irregular DA factor space. We demonstrate the benefits through the examples of boreholes model and damped harmonic oscillation. The perceivable benefits indicate that the proposed methodology is promising.

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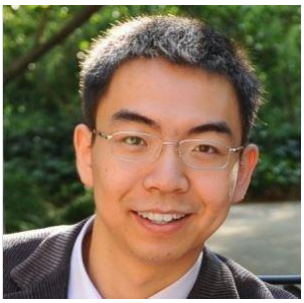
Notes

Session 2B: Sequential Experimentation Moderator: David Edwards
Thursday, October 6, 10:30 AM – 12:00 PM
Gallery

Novel Approaches in Designing Computer Experiments with Inert Factors



Shan Ba
The Procter & Gamble Company

Abstract: The implementation of computer experiments is a competitive advantage in business environments where fast and cost effective product development is critical. In many industrial applications computer experiments are replacing physical experiments because the physical creation and testing of prototypes is very prohibitive in terms of time and cost. Computer experiments typically involve complex systems with numerous input variables. A primary goal with computer experiments is to develop a metamodel - a good empirical approximation to the original complex computer model - which provides an easier and faster approach to sensitivity analysis, prediction and optimization. This talk will discuss and present new strategies to efficiently design computer experiments whose input factors may not be equally important. The first part of the talk will introduce the Maximum Projection (MaxPro) Design criterion, which automatically maximizes the space-filling properties of a design on projections to all subsets of factors. The MaxPro criterion has already been incorporated into the latest version of JMP and we will illustrate it using real industrial applications. In the second part of the talk, we will present a new sequential design strategy which could screen out the potential inert factors quickly.

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Notes

Session 2B: Sequential Experimentation Moderator: David Edwards
Thursday, October 6, 10:30 AM – 12:00 PM
Gallery

Augmenting Definitive Screening Designs for Estimating Full Quadratic Models

Abigael C. Nachtsheim
Arizona State University

Abstract: Jones and Nachtsheim (2011) recently introduced a class of three-level screening designs called definitive screening designs (DSDs). The structure of these designs results in the statistical independence of main effects and two-factor interactions; the absence of complete confounding among two-factor interactions; and the ability to estimate all quadratic effects. Because quadratic effects can be estimated, DSDs can allow for the screening and optimization of a system to be performed in one step, but only when the number of terms found to be active during the screening phase of analysis is less than about half the number or runs required by the DSD (Errore, et al., 2016). Otherwise, estimation of second-order models requires augmentation of the DSD. In this paper we explore the construction of series of augmented designs, moving from the starting DSD to designs capable of estimating the full second-order model. We use power calculations model-robustness criteria, and model-discrimination criteria to identify the numbers of augmented runs necessary to effectively identify all active model terms.

Additional Authors: Bradley Jones, SAS Institute; Christopher J. Nachtsheim, University of Minnesota: Twin Cities; Douglas C. Montgomery, Arizona State University.

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Notes

Session 2C: Technometrics Invited Session Moderator: Ron Fricker
Thursday, October 6, 10:30 AM – 12:00 PM
Salon B

Estimating a Parametric Component Lifetime Distribution from a Collection of Superimposed Renewal Processes

Bill Meeker
Iowa State University

Abstract: Maintenance data can be used to make inferences about the lifetime distribution of system components. Typically a fleet contains multiple systems. Within each system there is a set of nominally identical replaceable components of particular interest (e.g., two automobile headlights, eight DIMM modules in a computing server, sixteen cylinders in a locomotive engine). For each component replacement event, there is system-level information that a component was replaced, but not information on which particular component was replaced. Thus the observed data is a collection of superpositions of renewal processes (SRP), one for each system in the fleet. This paper proposes a procedure for estimating the component lifetime distribution using the aggregated event data from a fleet of systems. We show how to compute the likelihood function for the collection of SRPs and provide suggestions for efficient computations. We compare performance of this incomplete-data ML estimator with the complete-data ML estimator and study the performance of confidence interval methods for estimating quantiles of the lifetime distribution of the component.

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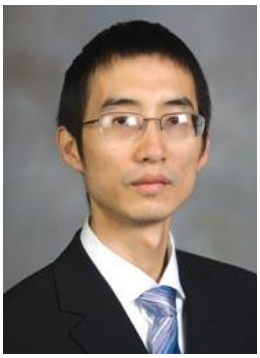
Notes

Session 2C: Technometrics Invited Session Moderator: Ron Fricker
Thursday, October 6, 10:30 AM – 12:00 PM
Salon B

A Multi-level Trend-Renewal Process for Modeling Systems with Recurrence Data

Yili Hong
Virginia Tech



Abstract: A repairable system is a system that can be restored to an operational state after a repair event. The system may experience multiple events over time, which are called recurrent events. To model the recurrent event data, the renewal process (RP), the nonhomogeneous Poisson process (NHPP), and the trend-renewal process (TRP) are often used. Compared to the RP and NHPP, the TRP is more flexible for modeling, because it includes both RP and NHPP as special cases. However, for a multi-level system (e.g., system, subsystem, and component levels), the original TRP model may not be adequate if the repair is effected by a subsystem replacement and if subsystem-level replacement events affect the rate of occurrence of the component-level replacement events. In this paper, we propose a general class of models to describe replacement events in a multilevel repairable system by extending the TRP model. We also develop procedures for parameter estimation and the prediction of future events based on historical data. The proposed model and method are validated by simulation studies and are illustrated by an industrial application.

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Notes

Luncheon
Thursday, October 6, 12:15-1:45 PM
Salon CDEF

Remembering Connie Borror

Douglas C. Montgomery
Arizona State University

Connie was a Professor in the Division of Mathematical and Natural Sciences at Arizona State University West. She earned her Ph.D. in Industrial Engineering from Arizona State University in 1998 and joined the Division of Mathematical and Natural Sciences in 2005. Her research interests included experimental design, response surface methods, and statistical process control. She has co-authored two books and over 50 journal articles in these areas. Connie was a Fellow of the American Statistical Association and the American Society for Quality and was an editor of the journal Quality Engineering, as well as a former director of the Certificate in Statistics Program and co-director of the Committee on Statistics at ASU. Connie was the 2016 ASQ Shewhart Medalist; the first woman to earn this distinction.

Her friends remember her as an inspiration and praise her as a wonderful, sweet spirit. Connie's Facebook page is still active, and her friends continue to cover it with cat GIFs.

Connie is survived by her sisters, Anna (John) Bringer of Granite City, Ill., and Donna Borror of Bethalto, Ill.; her brothers, Forrest (Darla) Borror of Granite City, Ill., and Dennis (Vicki) Borror of Greenville, Ill.; also by several nephews and a niece, as well as many great-nephews and great-nieces.

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Notes

Session 3A: Statistical Process Control
Thursday, October 6, 2:00 – 3:00 PM
Salon A

Moderator: Anne Driscoll

Application of a Multivariate Process Control Technique in a Set-Up Dominated Low Volume Manufacturing Operation

Steven Cox
Rotary Power Limited

Abstract: In traditional high-volume manufacturing applications, the timing of control adjustments to processes has been supported through the use of parametric Statistical Process Control (SPC) methods, such as Shewhart X & R charts. However, in high-value, high-complexity and low-volume industries, where production runs are in the order of tens rather than thousands, the traditional approaches to SPC do not apply. These types of processes are highly capable over a small production run and the dominant source of variation is between batches, known as *set-up dominant*. In the context of Shewhart SPC, this set-up dominance means that these processes are in a constant assignable cause state. Added to this is the complexity of manufactured components, with multiple critical features to monitor. This increases the difficulty for a process operator to maintain all critical features within their design tolerances.

In response to this, this paper presents a framework to blend a non-parametric SPC approach called multivariate Set-Up Process Algorithm (mSUPA), to identify when a control adjustment is required, and a discrete-event simulation tool to inform the process operator what adjustment to make. The first stage, mSUPA, uses a simple to interpret traffic light system to alert process operators when an adjustment is required. However, the mSUPA technique is underpinned by multivariate statistics and probability theory to validate a process set up.

When a control adjustment is needed to a process, it is typical to leave the optimisation of these process parameters to an operator's experience. The second stage of the framework presented outlines a discrete-event simulation tool that optimises the adjustment required to a process. This simulation applies a local search technique, to determine in a virtual space the most effective control adjustment.

In conclusion, this paper benchmarks this new mSUPA and simulation tool against the current industry practice of first article inspection. The results indicate that mSUPA tool is more effective at ensuring the process set up is not only within tolerance, but also near the design target.

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Notes

Session 3A: Statistical Process Control
Thursday, October 6, 2:00 – 3:00 PM
Salon A

Moderator: Anne Driscoll

Recommendations for Application of the k-chart for Phase I Analysis

Maria L. Weese
Miami University

Abstract: The k-chart, a kernel distance based control chart using Support Vector Data Description, has shown potential for use as a monitoring method for irregular shaped data. We have studied the k-chart in a Phase I analysis, i.e. to establish a baseline for an in-control reference sample through a large simulation study. We have compared various methods for estimating the bandwidth parameter of the Gaussian Kernel function, and evaluated the performance on different distributions with small and large dimension. To our knowledge k-chart performance has only been evaluated as a method for establishing a baseline in very limited situations. This work greatly expands on previous study and seeks to give practical advice on how, or if, to use this control chart.

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Notes

Session 3B: Optimal DOE
Thursday, October 6, 2:00 – 3:00 PM
Gallery

Moderator: Peter Goos

Properties of Optimal Designs for Dual Response Systems

Sarah E. Burke
Arizona State University

Abstract: There has been increased interest in experimental designs for systems with multiple responses. Previous work has described a new method for creating optimal designs for a system with two responses of interest where one response follows a normal distribution and the other response is a Bernoulli random variable. The optimality criterion for these designs is a weighted criterion that combines the D-optimal criterion for the normal response model and a Bayesian D-optimal criterion for a logistic regression model with specified model parameters. In this talk, we extend this class of optimal designs to include dual response systems where one response has a Poisson or gamma distributed response, in addition to the normal and binary cases previously considered. We investigate the effect of the weight placed on each response criterion on the resulting designs. In addition, we explore the effect of the specified priors for the nonlinear models on these designs. We evaluate these designs using design efficiencies and FDS plots for both linear and quadratic models.

Additional Authors: Douglas C. Montgomery, Connie M. Borror, Arizona State University; Rachel T. Silvestrini, Rochester Institute of Technology; Christine Anderson-Cook, Los Alamos National Laboratory.

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Notes

Session 3B: Optimal DOE
Thursday, October 6, 2:00 – 3:00 PM
Gallery

Moderator: Peter Goos

DP-Optimality as a Multiple Criterion and its Application to Split-Plot Designs

Shaun S. Wulff
University of Wyoming

Abstract: The purpose of this talk is to demonstrate the usefulness of the Pareto approach in selecting optimal completely randomized designs (CRDs) and optimal split-plot designs (SPDs) when there are combinations of traditional and modern design criteria of interest.

1. Motivation. Gilmour and Trinca (2012) have argued that optimal design criteria should include pure error degrees of freedom to estimate the unknown variance in CRDs. The resulting criterion can be shown to be combinations of multiple conflicting criteria to which a Pareto optimization approach is well suited. The Pareto approach conveniently allows the decision maker to evaluate the trade-offs among the criteria without having to check all of the criteria individually and without having to specify weighted combinations. The proposed approach also allows for simple extensions to incorporate pure error degrees of freedom into the selection of optimal SPDs.

2. Description of work done. In this talk, we present examples involving DP-optimality and show how this criterion combines the traditional D-criterion and pure error degrees of freedom. Trade-offs among the criteria are exploited to better understand the selection of these optimal CRDs. We will also demonstrate how this approach can be extended to SPDs. Results will be compared and contrasted to optimal SPDs discussed by Macharia and Goos (2010), Jones and Goos (2012), Vining et al. (2005) in order to make the value of the proposed approach evident.

3. Significance. Choosing optimal designs is inherently a multi-criteria problem. This research demonstrates a useful approach for selecting optimal designs, such as CRDs and SPDs, in light of these conflicting criteria. Design makers will be able to incorporate many strategies involving traditional design criteria, and even new design criteria, for selecting best designs.

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Notes

Session 3C: Industrial Applications
Thursday, October 6, 2:00 – 3:00 PM
Salon B

Moderator: Jon Lindenauer

Industrial Application of the Expanded Gage R&R Study

Louis Johnson
SnapDat Inc.

Abstract: Does a standard Gage R&R adequately assess your measurement system? Researchers often must include multiple instruments, laboratories, locations or other additional factors in their study. Simply repeating the standard study at all levels of the new factor is incomplete and very inefficient. This presentation will demonstrate how to determine the appropriate sampling plan, assign fixed and random factors, analyze important interactions and handle missing data. Several manufacturing and laboratory systems will be used to illustrate this new methodology when there are three unique goals in mind for the outcome of the study. Specifically, the expanded gage study will be used when the goal of the study is to establish measurement capability, compare two unique measurement systems or explore the sources of measurement variation.

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Notes

Session 3C: Industrial Applications
Thursday, October 6, 2:00 – 3:00 PM
Salon B

Moderator: Jon Lindenauer

Attribute MSA: Making the Most of your Binary Response

Thomas Rust
Autoliv

Abstract: This presentation will present four methods to validate and evaluate attribute measurement systems that cover all inspection methods that report binary outputs. Many measurements are limited to binary responses (i.e. pass or fail), especially in a manufacturing environment. This may be due to limitations in the measuring process, limitations on time, or limitations on resources. Critical decisions are made with these measurement methods, but few options are available to validate these methods compared to using variable data (e.g. Gage R&R). The AIAG MSA Reference Manual has very sparse options and most Six Sigma books hardly deal with it. But, in a critical manufacturing process, these measurement methods are common and need to be validated reliably.

This presentation will group all attribute measurement systems into four groups or possibilities: Variable measurements reported as attribute, variable characteristics that are measured with an attribute metric, attribute characteristics that are measured with variable data, and attribute characteristics that are measured with an attribute metric. Methods for each of these four groups will be discussed as well as real examples of how they can and have been applied. The results will be shown in simplified results similar to variable data indices. The first group can be analyzed with the underlying variable data in a Gage R&R or similar. The second method uses a more general form of the Analytical Method reffered to in the AIAG manual but it is more widely applicable with some possible assumptions when the data do not meet what were previously considered restrictions. The third method determines a distribution of both pass and fail conditions and evaluates their reliability (or capability) against a limit with confidence intervals. The last method relies on binomial probabilities but with realistic sample sizes that reflect the critical level of each metric.

These methods are significant because attribute measurement systems are being used, especially in manufacturing, to determine the status of critical characteristics. In the automotive safety industry as well as many others, these systems need to be validated reliably with feasible methods that don't require thousands of samples. These methods do that for most measurement methods with similar sample sizes to a Gage R&R.

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Notes

W.J. Youden Address
Thursday, October 6, 4:00-5:00 PM
Salon CDEF

Understanding Today's Complex World

Joanne R. Wendelberger
Los Alamos National Laboratory

Abstract: Shortly before his death, W. J. Youden (1900-1971), who was both a chemist and a statistician, completed the manuscript of *Risk, Choice, and Prediction*, published in 1974 and meant "for anyone…who wants to learn in a relatively painless way how the concept and techniques of statistics can help us better understand today's complex world"[1]. Today, we live in an increasingly complex world. In line with the 2016 Fall Technical Conference Theme, "Statistics and Quality, the Twin Pillars of Excellence," statistics and quality professionals possess valuable knowledge, tools, and experience for understanding increasingly complex phenomena. Fundamental concepts associated with sampling, error analysis, and design of experiments have laid a foundation for the development and evolution of a variety of approaches for addressing these complex challenges using data in a structured and principled manner.

[1] Complete Dictionary of Scientific Biography, Charles Scribner's Sons, 2008, http://www.encyclopedia.com/doc/1G2-2830904751.html

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Notes

Session 4A: Q&P Invited Session
Friday, October 7, 8:00-9:30 AM
Salon A

Moderator: Byran Smucker

Monitoring and Improving Quality via Consumer Comments

Alex J. Gutman
Procter & Gamble Company

Abstract: Procter & Gamble (P&G) receives millions of consumer comments each year and requires an efficient data-mining algorithm to identify products with unexpectedly high complaint counts, as these suggest potential quality or safety issues (aka "signals"). This talk will present an overview of P&G's adopted signal detection method, the Multi-Item Gamma Poisson Shrinker (MGPS), an empirical Bayesian method for disproportionality analysis. It will also discuss the application of text mining on consumer comments to find misclassified adverse events and identify fraudulent complaints.

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Notes

Session 4A: Q&P Invited Session
Friday, October 7, 8:00-9:30 AM
Salon A

Moderator: Byran Smucker

Statistical Methods for Data Science

Joanne Wendelberger
Los Alamos National Laboratory

Abstract: Statisticians have an opportunity to play an important role in the world of Big Data. In particular, by partnering with data scientists from other fields such as computer science and applied mathematics, innovative approaches can be developed to address problems involving increasingly large amounts of data in a rigorous and effective manner that take advantage of advances in computing. This presentation will highlight statistical concepts that can facilitate analysis of large-scale data including techniques for in situ analysis of large scale simulations, sampling and data reduction methods for representation of large data, and probabilistic algorithms for efficient processing.

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Notes

Session 4B: CPID Invited Session
Friday, October 7, 8:00-9:30 AM
Gallery

Moderator: Ashley Childress

Case Studies: There are No Answers in the Back of the Book

Jennifer Van Mullekom
DuPont

Abstract: Statistical techniques and applications are typically taught with straightforward data sets. This allows students to focus on execution, assumptions, and interpretation to internalize the fundamentals. Research is often guided by a specific model with well-defined assumptions. In contrast, real world studies and data are resource constrained. There is often a lack of time, resources, or money to design and collect data for the "optimal" study. Historical data fails to meet assumptions or is limited in quantity or quality. Yet, decisions must be made in the face of uncertainty. What is a statistician to do when there are no answers in the back of the book? This talk will highlight solutions to several real world case studies. These case studies require creativity, statistical engineering, and multi-disciplinary collaboration to link fundamental techniques to facilitate decision making.

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Notes

Session 4B: CPID Invited Session
Friday, October 7, 8:00-9:30 AM
Gallery

Moderator: Ashley Childress

Analysis of a Functional Response from a Mixture Experiment

Mona Khoddam
Arizona State University

Abstract: Mixture experiments are widely used in applications where the levels of the experimental factors are varying proportions of several chemical components that sum to a 100%. Previous and current work on the analysis of mixture data only involve single-response values. In this work, we discuss an application where the response from a mixture experiment is a series of data points collected over a continuum, known in the literature as functional data. This rheological response measure -- viscosity measured over varying shear rate -- relates to a critical-to-customer attribute namely, the consistency or "flow" of the product at use. Taking a single viscosity value at a fixed shear rate fails to capture the rheological differences among chemical formulations.

A real-world case study is presented as we discuss the challenges of using functional data analysis (FDA) models when the experimental data comes from a mixture experiment. Several FDA models are explored for model fit, predictive capability, and ease of interpretability for this particular application. Further, we show how the FDA model is utilized to find an optimized formulation relative to customer and business objectives. FDA models have been previously used for experimental data with factors that can be varied independently, but none have dealt with the peculiarities of modeling FDA data for mixture components.

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Notes

Session 4C: Journal of Quality Technology Invited Session
Friday, October 7, 8:00-9:30 AM Moderator: Duane Allen
Salon B

Nonparametric CUSUM Control Charts and Their Use in Two-Stage SPC Applications

Daniel R. Jeske
University of California, Riverside

Abstract: We develop a nonparametric CUSUM for sequential monitoring of independent and identically distributed observations when the underlying in-control density is arbitrary and unknown but can be estimated from historical data. Our approach utilizes a smooth bootstrap algorithm along with an adaptive nonparametric kernel density estimator to make the CUSUM work for reasonably sized sets of in-control data. We discuss how the CUSUM fits into a two-stage SPC algorithm.

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Notes

Session 4C: Journal of Quality Technology Invited Session
Friday, October 7, 8:00-9:30 AM Moderator: Duane Allen
Salon B

Residuals-Based CUSUM Charts for Poisson INAR(1) Processes

Murat Caner Testik
Hacettepe University

Abstract: In a recent study, Poisson INAR(l) CUSUM control charts have been proposed to monitor mean shifts of processes with count-type observations that are correlated over time. As a time series model for such observations, an integer-valued autoregressive process of order 1 with a Poisson marginal is considered. In this study, residuals of this model are used to monitor shifts that can be experienced not only in the process mean but also in the autocorrelation coefficient or the variance. For this purpose, univariate and multivariate CUSUM control charts are developed. Performance comparisons in Phase II of these CUSUM control charts indicate that different residual monitoring approaches should be used for different types of process shifts, which will be discussed in the presentation.

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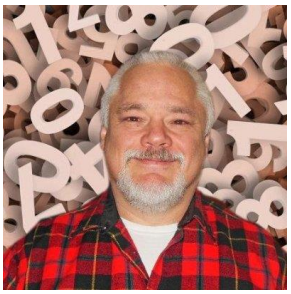
Notes

Session 5A: SPES Invited Session
Friday, October 7, 10:00-11:30 AM
Salon A

Moderator: Brad Evans

A Bayesian Alternative to the Sequential Probability Ratio Test for Attribute Sampling

Robert Noble
Teva Pharmaceuticals



Abstract: Sequential analysis of data from areas such as manufacturing, testing of human subjects, and designed clinical trials has become more common in the age of adaptive decision making. Currently, the sequential probability ratio test (SPRT) is the predominant method for classifying examinees in a variable length computerized classification test (CCT). A common criticism of the SPRT is its open-ended sample size. A Bayesian approach using predictive probability will be described and the evaluation of operating characteristics will be performed via a closed form solution using absorbing Markov chain.

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Notes

Session 5A: SPES Invited Session
Friday, October 7, 10:00-11:30 AM
Salon A

Moderator: Brad Evans

Resolving Conflict with Bayes and Statistical Engineering

Gregory Steeno
Pfizer, Inc.

Abstract: Laboratory assays are important sources of information used by medicinal chemists during the optimization of a molecule's chemical structure. Assays for absorption, distribution, metabolism, and elimination (ADME) are critical aspects of drugs and can have a profound impact on molecular design decisions. However, the chemists do not develop or own the assays, but rather just consume the results. The chemists may not understand the nature of the data in terms of variability, bias, and other factors, which usually triggers interrogating questions to the owners regarding assay behavior.

The task is to clearly communicate assay performance, in terms of what the assay can and cannot do, and resolve internal conflict.

Enter Bayes and Statistical Engineering.

Given a large pool of historical assay results, the variability in a singleton assay value can be determined using statistical techniques, specifically Bayesian analysis. This type of methodology can properly utilize prior data to help generate more informative estimates of ADME assay results and fold-differences between compounds of interest. The techniques are illustrated using two ADME assays.

But, effectively conveying these results to chemists is as important as the results themselves. Supported by a multipronged collaboration between various organizations, an interactive web-based tool was developed to dynamically communicate analyses and visualizations, and will be showcased.

Both the approach and the tools provide a method to arrive at a common understanding and allow those who use the data and those who generate the data to work together more effectively.

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Notes

Session 5B: Screening Experiments
Friday, October 7, 10:00-11:30 AM
Gallery

Moderator: Flor Castillo

Considerations for Screening Experiments with Partial Replication

David Edwards
Virginia Commonwealth University

Abstract: Small screening designs are frequently used in the initial stages of experimentation with the goal of identifying important main effects as well as to gain insight on potentially important two-factor interactions. Commonly utilized experimental designs for screening (e.g., resolution III or IV two-level fractional factorials, Plackett-Burman designs, etc.) are unreplicated and as such, provide no unbiased estimate of experimental error. However, if statistical inference is considered an integral part of the experimental analysis, one view is that inferential procedures should be performed using the unbiased pure error estimate. As full replication of an experiment may be quite costly, partial replication offers an alternative for obtaining a model independent error estimate. Gilmour and Trinca (2012, *Applied Statistics*) introduce criteria for the design of optimal experiments for statistical inference (providing for the optimal selection of replicated design points). We begin with an extension of their work by proposing a Bayesian criterion for the construction of partially replicated screening designs with less dependence on an assumed model. We then consider the use of the proposed criterion within the context of multi-criteria design selection where estimation and protection against model misspecification are considered. As screening experiments typically involve the performance of experiments in sequence, we also present an investigation into the screening process by considering optimal partially replicated follow-up designs. Insights for analysis and model selection in light of partial replication will be provided.

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Notes

Session 5B: Screening Experiments
Friday, October 7, 10:00-11:30 AM
Gallery

Moderator: Flor Castillo

Screening Experiments involving Two Crossed Blocking Factors

Peter Goos
KU Leuven

Abstract: Many experiments span multiple days, use material from several batches and/or involve more than one operator. In such scenarios, blocking the experiment is important. Many textbooks discuss how experiments should be blocked when there is a single blocking factor. It is, however, not uncommon to have more than one blocking factor in an experiment. In this talk, we discuss the problem of designing screening experiments involving two crossed blocking factors. The required experimental designs in the presence of two crossed blocking factors are generally named row-column designs.

We show how integer linear programing can be used to arrange any given two-level orthogonal screening design in rows and columns, so that the main effects can be estimated independently from the block effects, and so that as many two-factor interaction effects are estimable as possible.

The motivating examples for the talk are a 24-run and a 28-run screening experiment performed by a car tire manufacturer to study the impact of 12 two-level factors on the wear of tires. Since only a limited number of experimental runs can be performed per day, and since several drivers are used for the experiment, the experiments involve two crossed blocking factors.

The novel features of the talk are (i) the fact it consider two blocking factors, (ii) the fact that the numbers of runs considered are not powers of two but multiples of four, and (iii) the large flexibility the approach offers.

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Notes

Session 5C: Quality Engineering Invited Session
Friday, October 7, 10:00-11:30 AM Moderator: Adam Pintar
Salon B

Improving Reliability Understanding through Estimation and Prediction with Usage Information

Christine M. Anderson-Cook
Los Alamos National Laboratory

Abstract: Using information about the usage or environmental exposure of a complex system in addition to its age can provide additional understanding about mechanisms driving change in reliability as well as potentially improve the prediction. Both the individual reliability of particular units as well as population reliability can be improved by including additional explanatory factors. In this talk we consider an example based on a complex munition system. Using age alone to predict reliability can provide some information, but differences between units of the same age cannot be discerned. Subpopulations can be identified to help improve estimation, but the largest gains in understanding of the mechanisms driving change in reliability and prediction of future performance come from incorporating usage information.

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Notes

Session 5C: Quality Engineering Invited Session
Friday, October 7, 10:00-11:30 AM Moderator: Adam Pintar
Salon B

Statisticians as Innovation Leaders

Kymm K. Hockman
DuPont Electronics & Communications

Abstract: In today's competitive environment, companies are looking to remain financially strong by increasing their profitability. Innovation leading to business growth is increasingly important. In this presentation we discuss the unique roles that statistics and statisticians can play in facilitating and leading innovation efforts. Data-based decision making, systems thinking, an independent perspective and the ability to influence others all work together to equip and position the statistician to lead growth project work to successful commercial success. Examples from real statistician-led projects will illustrate the role of statistics in making wise commercialization decisions. Finally, recommendations will be discussed on how the statistics field will need to broaden the skill base to prepare innovation leaders of the future.

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Notes

Luncheon
Friday, October 7, 11:45 AM-1:15 PM
Salon CDEF

Communicating the Value of What Statisticians Do

Jessica Utts
President, ASA

Abstract: As statisticians we know the value of our work. But because our contributions are generally part of a team effort, it may be difficult for others to recognize and appreciate what we do. From your boss to your grandmother (or grandchildren!), helping others understand our collective accomplishments is worthy of our attention. Statistical thinking can help businesses, communities and individuals make better decisions. Educating policy-makers in government, managers in business and industry, and educators at all levels on the usefulness of statistics can help our work have an even greater impact on society than it does now. This talk will cover some of ASA's efforts to communicate with various audiences, and what statisticians can do to help.

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Notes

Session 6A: Inspection Validation
Friday, October 7, 1:30-3:00 PM
Salon A

Moderator: Thomas Rust

The Use of Acceptance Sampling Plans in the Validation of Inspection Methods

Mark Balhorn
Boston Scientific Corporation

Abstract: Current, popular statistical measures for the validation of inspection methods fall short in three ways. Either: (a) the metric combines the distinctly different elements of Type I and Type II error into one metric; (b) the metric cannot be directly interpreted to determine the effectiveness of the inspection; and/or (c) the metric is only a point estimate, with no visible consideration of power or uncertainty. This presentation introduces a sampling plan approach to Attribute Test Method Validation (ATMV) and compares its performance against the kappa method and general clinical metrics. Following this comparison, I will demonstrate how to set up and execute a risk-based ATMV using sampling plans for visual inspection and other binary classification tests. Passing the sampling plan approach validates that the inspection system meets the required performance level and addresses all of the concerns highlighted above.

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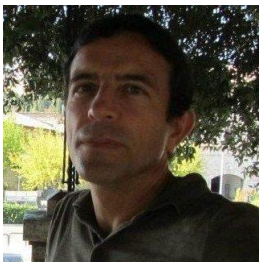
Notes

Session 6A: Inspection Validation
Friday, October 7, 1:30-3:00 PM
Salon A

Moderator: Thomas Rust

Assessing Inspection Tools performances through capture rate

Dario Nappa
Qorvo, Inc.



Abstract: When releasing defect inspection tools a major concern is evaluating the tool performance. A typical approach is to use one of the three metrics: Kappa Index, GRR and Cross-correlation. We found that the above approaches do not address the major concern: "What is inspection tool capability to capture defects and how does this relate to Acceptable Quality Level (AQL) requirements". We developed a methodology to estimate Capture Rate and use it to evaluate inspection tools.

Work done:

We found that using capture rate (chance to detect a defect) is the preferred metric since it links to AQL for which we have well-defined customer requirements.

We developed a theory linking Capture Rate, GRR and Kappa Index and AQL. The theory highlights the weaknesses in Kappa Index and GRR methodology.

We developed a methodology to:

- Estimate Capture Rate
- Set requirement on Capture Rate based on AQL.
- Compare the performance of inspection tools.

Significance:

In the past we used Kappa Index and GRR but those methods provided metrics and results that did not make sense and requirements (for example, what is an acceptable level for Kappa Index) that seem arbitrary. The new method provides metrics that can be easily understood, we can easily link to well-defined requirements (AQL) and can be easily translated into actions.

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Notes

Session 6B: Variations in Mixture DOE
Friday, October 7, 1:30-3:00 PM
Gallery

Moderator: Greg Piepel

Restricted-Randomization Optimal Design of Experiments Combining Mixture and Non-Mixture Factors

Martin Bezener
Stat-Ease, Inc.

Abstract: Mixture designs are common in a number of industries, particularly in the process industries--chemical, food, pharmaceutical, etc.. These designs are employed in settings where at least two of the experimental factors under consideration must sum to a fixed total. Non-mixture factors, or *process factors*, may also be included in the experimental design. Classical randomized designs require that each run use an independent preparation of the mixture, and that the process factors be completely re-set between runs. This requirement, however, is usually impractical. It is often only possible to prepare batches of the mixture to be tested under varying settings of the process factors. In other situations, the mixture may be easy to prepare, but it is expensive or time-consuming to reset the process factors. This restriction on randomization induces a split-plot structure in the experimental design which, unfortunately, is often ignored.

Despite the prevalence of this situation in practice, designs of this type have not received much attention in the literature. In this talk, we briefly review the classical mixture design and common scenarios settings where it is used. We then discuss a split-plot version of this design and briefly mention a mixed model approach for statistical analysis. We continue with a discussion of a novel algorithm for the optimal construction of these designs, and numerical issues that may be encountered. Attention is also given to practical issues such as sample size and the optimality criterion throughout the talk. We conclude by illustrating a real-world mixture-process experiment involving the optimization of coffee made from various beans and brewed up in our company's cafeteria.

Additional Authors: Patrick Whitcomb, Wayne Adams, Henry Anderson, Stat-Ease.

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Notes

Session 6B: Variations in Mixture DOE
Friday, October 7, 1:30-3:00 PM
Gallery

Moderator: Greg Piepel

Order-of-Addition Experiments

Joseph G. Voelkel
Rochester Institute of Technology

Abstract: The order in which components are added in a chemical batch, film, food products, or a study of protein transport may be a primary consideration in an experiment.

We review work that has been used for such order-of-addition (OofA) experiments, and propose extensions to them. We define a reference standard of OofA experiments by extending the idea of orthogonal arrays. For strength 2 designs, upon which we focus most of our attention, we find that OofA orthogonal arrays require $N = 0 \mod 6$ runs. We consider a χ^2 criterion for the balance of the array, and also a Hamming-distance criterion among the rows of the design. We find empirically that D-optimal designs (using a particular set of columns in the model matrix) usually perform very well under each of our two criteria. For these reasons, as well as its general availability, we recommend this method for design construction.

We then extend these optimal OofA designs to incorporate standard process variables so that, for example, temperature or mixing speeds may be included as well. Our methods also may take into account natural restrictions that the experimenter may have, such as requiring that one component is always added before another. Our main emphasis is on the design of OofA experiments, but we also provide some suggestions and examples for analysis.

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Notes

Session 6C: Case Studies & Applications Moderator: Jennifer Kensler
Friday, October 7, 1:30-3:00 PM
Salon B

Pulp Machine Sheet Break Reduction

Jon M. Lindenauer
Weyerhaeuser Company

Abstract: Weyerhaeuser is one of the largest producers of market fluff pulp in the world. One of the mills was experiencing more pulp sheet breaks than normal. A sheet break stops the continuous pulp production process for 2 to 8 hours. This lost production costs a lot of money. Substantially reducing pulp machine sheet breaks could result in millions of dollars in increased revenue.

A QIS (Quality Improvement Storyboard) team made up of mill supervisors, engineers, operators and a statistician was formed to solve the problem. The team goal was to reduce sheet breaks by 50%. Information was gathered to identify potential root causes of the sheet breaks. The team felt that the key to solving the problem lay in mining the large amount of archived process data. The team worked together to identify process tags that could affect sheet breaks. Data for six months of production runs was collected. The data included runs that resulted in a sheet break and runs that did not result in a sheet break.

A partial least squares (PLS) discriminant analysis of the data showed that several process tags were important for discriminating whether a run would result in a sheet break. The pulp machine supervisor initiated operating changes based on the teams' problem solving. Key process tags identified by the statistical analysis were monitored and alarmed using statistical process control charts.

The mill reduced sheet breaks by over 65% and saw a significant revenue increase. An added benefit was that machine speed was increased as these changes were put in place. The QIS teams' results have also supported the sustainable and efficient use of wood and energy resources.

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Notes

Session 6C: Case Studies & Applications Moderator: Jennifer Kensler
Friday, October 7, 1:30-3:00 PM
Salon B

Decision trees for mechanical system root cause investigation

Chad Foster
GE Aviation

Abstract: Traditional issue resolution approaches using fishbone diagrams, five whys, and FMEAs have limited methods to utilize big non-linear, discontinuous, and noisy data. Modern manufacturing and test systems are gathering an even increasing data set on each measurement and performance test. Finding fruitful areas for issue resolution, based on physics, and supported by the data has become more challenging given these additional data. A big benefit of historic methods is the native incorporation of development experts which is lacking in most well used statistical procedures.

We present a decision tree root cause identification technique for large mechanical systems issues. This procedure was implemented on three different issues and used to progress the testing and eventual resolution of the issues. The benefit of using the decision tree makes improvement due to three characteristics:

1. It is a greedy algorithm which prioritizes variables.

2. Non-linear, noise tolerant, models are built without developmental model assumptions.

3. Inherently a visual method to integrate experts and facilitate hypothesis building.

This is a classic statistical model method that has not previously been proceduralized for mechanical system issue resolution. We demonstrate the utility, benefits, and potential issues for this new application. This method helps resolve a growing gap where the manufacturing and test data exceeds the engineering tools that assist with issue investigation. Future development of interpretable tools that fuse the ability of the design engineering team with the growing data sets will create significant commercial value.

Additional Authors: Grant A. Malmedahl, GE Aviation.

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Notes

SPES Special Session
Wine & Cheese Reception
Friday, October 7, 3:15-5:15 PM
Salon CDEF

Moderator: Anne Driscoll

Leadership Perspectives: A Multifaceted Panel Discussion

Panelists:

Christine Anderson-Cook, Project Leader, Los Alamos National Laboratory
Ron Fricker, Department Head, Virginia Tech (Statistics Department)
Jessica Utts, President of the American Statistical Association
Kevin White, Group Leader (Applied Statistics), Eastman Chemical Company

Statistical Leadership has received much attention from the American Statistical Association in publications and recent conferences. The American Society for Quality strives to train and cultivate member leaders. This panel will examine leadership from multiple perspectives. Participants include those with experience in corporate, academic, project, thought, and professional society leadership. Please join us to hear their success stories and lessons learned. Take advantage of this wonderful opportunity to get your questions answered by experienced, highly respected leaders in our field.

Notes

Call for Papers

61st Annual Fall Technical Conference

Statistics: Powering a Revolution in Quality Improvement

October 5-6, 2017

Sheraton Society Hill, Philadelphia PA

Co-sponsored by:

American Society for Quality
Chemical and Process Industries Division
Statistics Division

American Statistical Association
Section on Physical and Engineering Sciences
Section on Quality & Productivity

We invite you to submit abstracts for presentation at the 61st Fall Technical Conference to be held on October 5-6, 2017, in Philadelphia, PA. The Fall Technical Conference has long been a forum for both statistics and quality and is co-sponsored by the American Society for Quality (Chemical and Process Industries Division and Statistics Division) and the American Statistical Association (Section on Physical and Engineering Sciences and Section on Quality and Productivity). The goal of this conference is to engage researchers and practitioners in a dialogue that leads to more effective use of statistics to improve quality and foster innovation.

If you are interested in presenting an applied or expository paper in any of the categories of Statistics, Quality, Experimental Design, or Tutorial/Case Studies, contact any of the committee members listed below, preferably by e-mail. Work should be strongly justified by application to a problem in engineering, manufacturing, big data, process/chemical industry, physical sciences, or a service industry. The mathematical level of the papers may range from basic to that of the *Journal of Quality Technology* or *Technometrics*. Please note which level of audience is targeted (Introductory, Intermediate, or Advanced) so the committee can assign papers appropriately and plan a balanced program. The program committee welcomes any suggestions for special session topics or speakers. If you have ideas, please contact one of the program committee members listed below.

Abstract Submission Deadline is February 28, 2017

Program Committee

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Please follow the abstract format (provided below). Papers are selected based on subject matter, technical correctness, usefulness, interest, clarity, and readability.

Abstract Format (1 Page Max)

Title of Presentation

First author	Second author	Third author
Affiliation	Affiliation	Affiliation
Daytime phone number	Daytime phone number	Daytime phone number
Paper mail address	Paper mail address	Paper mail address
Email address	Email address	Email address

Presenter: name of presenter
Keywords: include 3 to 5 key words or phrases
Purpose: One sentence. To derive, prove, synthesize, review, present, inform, encourage, motivate, enlighten, exemplify, highlight, etc.

Abstract
The abstract should include the following 3 components:

1. Motivation or background
2. Description of work done
3. Significance. Are there improvements, applications, new abilities, new points of view, etc? How will the status quo be changed?

Session Preference (choose one)
___ Statistics
___ Quality
___ Experimental Design
___ Tutorial/Case Study

Target Audience (choose one)
___ Introductory/Practitioner
___ Intermediate
___ Advanced/Theoretical

One presenter for each talk will receive a 50% discount on conference registration.