



*Joint Newsletter for the Section on
Physical and Engineering Sciences and the
Quality and Productivity Section of the
American Statistical Association*

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**Message from the
SPES Associate Editor**

Jim Rutherford, Chevron Oronite Company LLC

If you are reading this message, we succeeded in getting out the newsletter. This was accomplished in spite of the associate editor's rookie slowness through the effort of many diligent people. Now that is out of the way and it is time to start thinking about what goes in the next newsletter. Please don't hesitate to contact me with your ideas and submissions.

**Message from the
Q&P Associate Editor...**

There was some debate last year, but now it is official: we are in the 21st. century. Congratulations to all of you who survived the increasingly fast-paced end of the last one! Unfortunately, the pace seems to keep getting faster. As you can tell, I am sick of "time-fleeting" disease. In a related topic, here we are already in the middle of 2001 and bringing you the summer issue of the newsletter. I hope that you find it informative. Among the materials included, there is an interesting note from the Chair, the list of Mary G. Natrella awardees, and information about the Atlanta meetings. Also, there is a very interesting review by Bill Parr that I think will be of interest for most members of the section.

In the meantime, stop and smell the roses. Remember that life is only a temporary situation.

—Esteban Walker

Message from the SPES Chair

Christopher J. Nachtsheim, University of Minnesota

As I write this in April, I am a little over a quarter of the way through my term as Chair. I've been a lot busier than I thought I would be—learning, talking with people, writing uninteresting columns, and making errant decisions on behalf of the membership. Apparently it only gets worse, as my predecessors tell me that the last half of the year is where the real action is. I can understand that as I look at what your SPES leadership has in store for you in the next few months.

Spring Research Conference on Statistics in Industry and Technology

The SRC will be held June 18-20 in Roanoke, Virginia. Max Morris (invited program chair), Bruce Ankenman (contributed program chair) and Christine Anderson-Cook (local arrangements chair) have put together a great conference. For information, go to www.public.iastate.edu/~stat/conference/main1.html. By the way, thanks to Rob Easterling's leadership, a new, five-year agreement between SPES and IMS for continued sponsorship of SRC has been concluded. The new agreement expands the Management Committee to seven members, three from each sponsoring organization, and a Chair, jointly appointed by the two sponsors. I want to thank Fred Hulting for agreeing to serve as our third SPES Management Committee member. Fred has been involved with the conference for a number of years and will bring valuable insight to that group.

Joint Statistical Meetings

This year the JSM will be held in Atlanta, August 5-9, and the SPES program elves have been busy. We will sponsor or co-sponsor seven invited sessions, 11 contributed paper sessions, and six round-table luncheons. I perused the Web site recently and was truly impressed. The on-line program is available for viewing at <http://www.amstat.org/meetings/jsm/2001/onlineprogram/index.cfm>. You can pull up all of the SPES-sponsored sessions by doing a "search by sponsor." The sessions look really timely and interesting, and I want to thank Joanne Wendelberger (Program Chair 2001), Russ Lenth (Program Chair 2002), and all of the others who've helped to create such an outstanding program. Nice work!

Perhaps even more important is the fact that the SPES/Q&P joint business meeting and mixer is scheduled for 5:30-7:30PM on Tuesday, August 7. As always, there will be free food, door prizes, and people of exceptionally high caliber. I'm hoping to sneak in.

Fall Technical Conference

The Fall Technical Conference will be held in Toronto, Canada on October 18-19. Connie Borrer is our SPES representative on the program committee, which has assembled—as usual—an excellent program. The Web site of interest for this one is www.amstat.org/sections/spes/FTC_CFP.htm. This has always been one of my favorite conferences, and I look forward to introducing the Friday Luncheon speaker, ASA President Richard Schaeffer.

SPES Section Survey

In my December "Message," I made the mistake of saying in public that a survey of the SPES membership was one of my goals during my year as Chair—this has forced me to follow through on the commitment. Fortunately, with the help of my predecessor, Fred Hulting (2001 Past Chair), and my successor, Chuck Bayne (2001 Chair-Elect), a first draft of the survey has been completed. The survey has three basic goals: to learn a bit more about our membership, to find out what you think about our current slate of activities, and to find out what new services we should be offering. All of this is in support of strategic planning this fall. My purpose here is to get you to do some advance thinking about our activities. By way of review, SPES currently:

- Organizes invited and contributed sessions at the annual meetings
- Organizes short courses for the annual meetings and Fall Technical Conferences
- Organizes section mixers (joint with the Section on Quality and Productivity) at the annual meetings
- Organizes roundtable luncheons at the annual meetings
- Publishes proceedings from the annual meetings, including the Spring Research and Fall Technical Conference papers
- Sponsors the Best Presenter Award Program for outstanding contributed papers in the SPES sessions at the annual meetings
- Co-sponsors Fall Technical and Spring Research Conferences
- Provides on-line information via the SPES WWW page and monthly news items in the *Amstat News*
- Produces biannual SPES/Q&P News newsletters
- Offers an Industrial Speaker Program
- Sponsors a Chemometrics Committee
- Provides fellowship with other statisticians with interests in physical and engineering sciences

Please think about whether or not these activities have been of value to you and give some thought to new directions for our section. If you have ideas, don't hesitate to contact me by phone at (612-624-177) or by email at cnachtsheim@csom.umn.edu. I'd very much like to hear from you, and there's no need to wait for the survey!

Final, Self-Serving Remarks

The more time I spend working with SPES, the more impressed I am with the way it runs. In creating draft one of the survey mentioned above, I spent some serious time browsing through all of the other ASA section Web sites. I had two objectives: (1) steal copies of old surveys, and (2) assess what the other sections are up to -- in effect to try to compile a list of section best practices. That "study" led to the following (biased) conclusions. (1) We are clearly one of the most active and best-run sections. We provide as many services for our membership -- per capita -- as any ASA section. (Thanks to all who have worked so hard and contributed so much over the years!) (2) Our Web site is world (ASA) class. (Thanks, Randy Tobias!) (3) I *was* able to illicitly procure some surveys.

Have a great summer, and I hope to see you in either Roanoke, Atlanta, or Toronto!

Message from the Q&P Chair

Eric Lagergren, Kraft Foods

As I reflect on the progress we are making to fulfill our Tactical Plan (see page 3 of the December 2000 newsletter at <http://web.utk.edu/~asaqp/newsletters/1200newsletter.pdf>) I realize that so much of it revolves around "going electronic". We are looking for ways to communicate better with our members and one key way is electronically through email and the Web. We want to let you know about important Q&P section activities such as the availability of our newsletter and conference information in a timely, unobtrusive fashion.

Electronic Communication

Clearly electronic communication is a sign of the times. So much of our daily activity revolves around electronic communication, it makes you wonder how we ever survived without it. I am sure some of you long for those simpler times, especially when you've returned to the office after a week's vacation only to find your inbox loaded with emails. Makes you wonder why you ever came back in the first place. Email is surely both blessing and bane. While I dread finding a load of emails after returning from vacation, I do love being able to think of a question and finding the answer (or at least an answer) on the Web in a matter of minutes. It is pretty amazing when you think of it.

We are in the initial stages of working with ASA to have them develop and maintain email lists of section members. The need for this is clear. We want to improve our communication with you. We can do it better by email, so we need a complete and correct list of email addresses for section members. Of course such a list is out of date as soon as it is compiled, and so continual maintenance by ASA will be required. I am sure some of you have concerns about the potential abuse of such a list. Will it be sold to other organizations? Will you be "slimed" by yet another organization? While the details need to be worked out, I can assure that we are fully aware of these concerns and share them. I certainly do not want my email address sold to another organization and if you feel the same, you can request this from ASA. As far as sliming, the list would only be accessible by a few section officers and I would not imagine us sending an email more than once a month. Of course you choose to be a member of the section, so that you can become aware and take advantages of section activities. I imagine the email would consist of a short blurb and link to our Website (<http://web.utk.edu/~asaqp/>) where you could get more detail if you are interested. It would be somewhat like receiving the headlines from your favorite newspaper (or better monthly periodical).

Now here is where you come in. We currently do not have email address for about 25% of our section members. I also wonder about the accuracy of the 75% that we do have. Please take a few minutes and check the ASA

Web site at <http://www.amstat.org/membersearch/index.cfm> to submit your email address if you have not already done so and to check that it is correct if you have. Thanks for taking the time and I would like to hear your comments on this issue (lagergrene@Nabisco.com).

Quality and Productivity Research Conference

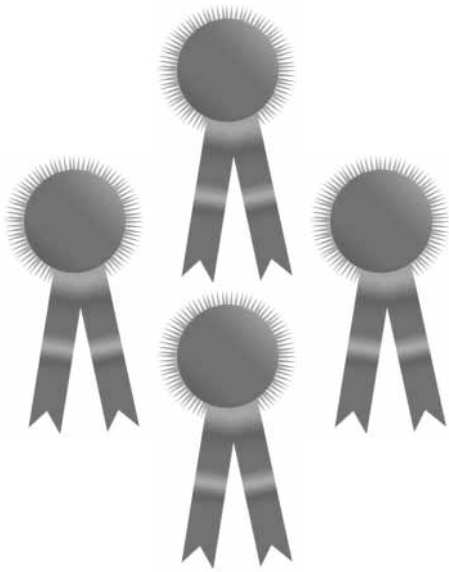
By the time you receive this we will have recently completed the 18th Quality and Productivity Research Conference, which I am sure will have been a rousing success. Thanks to Paul Tobias and his committee for the great preparation they have done to develop such a strong program. Also, thanks to Jeff Hooper for his stewardship of the conference for so many years.

Joint Statistical Meetings

We are gearing up for the Joint Statistical Meetings in Atlanta, August 5-9. Elsewhere in this issue you will see details of the strong program organized by Cheryl Jennings, roundtable luncheons by Angie Neff, and short courses by Steve Zayac and Tim Robinson. My thanks to all of them for their fine work and dedication. If you have any suggestions for next year's program please contact Angie, and for short courses, Steve or Tim. You can find their contact information on the second to last page of this issue. I strongly encourage you to attend not only our technical sessions, but also our business meetings as well. Sunday afternoon our Tactical Planning Session will be led by our chair-elect, Fred Faltin. Our regular business meeting is currently scheduled for Monday morning, and our joint mixer with SPES for Tuesday evening. Please make every effort to participate in some or all of these activities ... there's door prizes, free wine and beer at the mixer, but hey no one is twisting your arm here.

Thanks

Finally I would like to thank everyone on the Executive Committee for their dedication and great work this year. I feel we are making great strides in meeting the goals set forth in our Tactical Plan and that only happens with the hard work of many dedicated individuals. For those of you not currently involved in the section, I strongly encourage you to get involved. It truly is a rewarding experience and, especially in these times, a great opportunity to network. The best way to do this is to participate in our many activities at the JSM. Hope to see you there!



Mary G. Natrella Awards

Veronica Czitrom

Many well-qualified students applied for the Mary G. Natrella scholarship to attend this year's Quality and Productivity Research Conference, to be held in Austin, Texas on May 23-25. Four students were awarded scholarships for \$1,000 each, as well as free registration which includes several conference meals. The students are:

- **Susana Eyheramendy**, from Rutgers University, nominated by Prof. Regina Y. Liu
- **Yong Jiang**, from the University of Iowa, nominated by Prof. Russell Lenth
- **Xu (Susan) Jiaqiong**, from the University of Waterloo, nominated by Prof. Stefan Steiner
- **Willis Jensen**, from Brigham Young University, nominated by Prof. G. Rex Bryce

LeRoy Franklin will present the awards at the conference during the Wednesday evening dinner and awards ceremony. For more information on the conference, go to www.sematech.org/public/news/conferences/qp2001.

The four scholarships were funded by the following sources: one by the Mary G. Natrella Scholarship Fund endowment chaired by Veronica Czitrom, two by the Quality and Productivity Research Conference chaired by Jeff Hooper, and one by the Quality and Productivity Section of the ASA chaired by Eric Lagergren.

The Mary G. Natrella Scholarship Committee is part of the Quality and Productivity section of the ASA. The committee members are Veronica Czitrom, Chair, LeRoy Franklin, Q&P treasurer, Karen Kafadar, Carroll Croarkin, and Eileen Boardman.

SPES Awards for Outstanding Presentations Announced

Will Guthrie, Awards Chair, NIST

The Section on Physical and Engineering Sciences is pleased to announce the results of its annual Outstanding Presentation competition. These awards are based on audience evaluation of papers contributed to SPES-sponsored sessions at the Joint Statistical Meetings. The purpose of the awards is to encourage continuous improvement in the presentation of statistical information by recognizing at least some of the truly excellent talks given each year in SPES sessions. For the first time, this year's winners will receive cash awards as part of their recognition. \$100 will be awarded for best presentation, \$50 will be awarded for runner-up, and \$25 will be given for honorable mentions. Certificates will also be awarded. The awards this year, which will be presented at the SPES mixer during the meetings in Atlanta for papers given at the 2000 JSM in Indianapolis, are:

Outstanding Presentation Award to Dr. Alden Starnes, of Bluefield College, for his SPES Contributed Paper presentation, "Asymptotic Results for Model Robust Regression".

Runner-Up Outstanding Presentation Award to Dr. Jeffrey Green, of Ball State University, for his SPES Contributed Paper presentation, "Another Test For The Location Parameter Of The Two-Parameter Exponential Distribution".

Honorable Mention Outstanding Presentation Award to Dr. Michael Mosier, of the University of Kansas Medical Center, for his SPES Contributed Paper presentation, "Confidence Intervals for Contrasts Involving the Fixed Effects in a Balanced, Three Factor Mixed Model".

Honorable Mention Outstanding Presentation Award to Dr. Gregory F. Piepel, of the Battelle Pacific Northwest National Laboratory, for his SPES Contributed Paper presentation, "Augmenting Scheffe Linear Mixture Models with Squared and/or Crossproduct Terms".

I would also like to thank Dr. William S. Griffith of the University of Kentucky who helped with the data collection for the awards from the Indianapolis meetings. Without the help of dedicated volunteers, the SPES awards program would not be possible.

If you would like to see your name listed among the SPES Outstanding Presentation Award winners next year, just start sharpening your speaking skills for Atlanta! If you would like to help with the data collection for the Presentation Awards at future meetings, please contact William Li, the new SPES Awards Chair for 2001-2002, at wli@csom.umn.edu or 612-625-6841. Volunteers will be recognized on the SPES Web site and in the newsletter. Your involvement would be much appreciated.

Bill Woodall, New Editor and Awardee

Bill Woodall (Virginia Tech) has been named the editor of the *Journal of Quality Technology* (JQT). The *Journal Citations Reports*, ranks JQT 11th among all statistics and probability journals according to the "citation impact factor" which is based on number of citations. Bill also won the 2000 Brumbaugh award from the American Society for Quality (ASQ). It is given for ".....the paper published in an ASQ journal which made the largest contribution to the development of industrial applications of quality control." The paper is "Controversies and Contradictions in Statistical Process Control" published in the *Journal of Quality Technology*, 32, pp. 341-378. Discussants include Roger Hoerl, Andrew Palm, Don Wheeler, Bob Rodriguez, David Banks, Tom Ryan, Stefan Steiner, Jock MacKay, Charles Quesenberry, Poul Thregod and Jorgen Iversen. The entire paper and the discussion is available at <http://jqt.asq.org>.

Please Register Your EMail Address with ASA!

SPES and Q&P, as well as other sections, would like to communicate with members via email when possible rather than by postal mail, to deliver information more quickly and for less cost. At last count, about 25% of our members did not have email addresses registered with the ASA.

Please check to see if your current email address is registered: Go to <http://www.amstat.org/membersearch/index.cfm> and search for your name. Click your name to check your contact information. If you need to enter or change your email address, follow these steps: Go to <https://www.amstat.org/membersonly/default.asp> and log in. You will need your Member ID and Password. If you do not have those, you can click a button to ask ASA to send them to you. Click Member Information Update Form. Scroll down until you see the spot for your email address, enter it, and click Submit.

Thank you!!

Chapters & Sections

Visit the joint Chapter & Section information booth at JSM in Atlanta for their latest information. Chapter and Section members will be available to answer your questions; distribute pamphlets and brochures; display sample Section newsletters and the Council of Chapters' quarterly newsletter LINK which is currently on the Internet; have membership applications to join, as well as a COC Careers in Statistics PowerPoint presentation online. Officer rosters will be available for viewing as well as updating information.

All Chapter and Section officers may also pick up a new officer ribbon for their name badge at the booth as well. In addition, there will be free prizes for the first 50 visitors to the information booth.

ASA has 78 Chapters that are the geographical groups of members spread throughout the U.S. and Canada. Twenty-one Sections of the ASA represent a common interest area of members from all over the world.



SPES, Q&P and Co-Sponsored Activities at JSM 2001

DATE	TIME	TITLE	ACTIVITY
Sunday August 5	4 pm – 5:50 pm	Dimension Reduction for Simulation Science	Invited Session (SPES)
	4 pm – 5:50 pm	Topics on Reliability and Failure Analysis	Contributed Session (Q&P, SPES)
Monday August 6	8:30 am – 10:20 am	Experimental Design Strategies (Dedicated to the memory of Oscar Kempthorne)	Contributed Session (SPES, Q&P)
	10:30 am – 12:20 pm	Generalized Linear Models in Industry: Design & Analysis	Invited Session (Q&P, SPES)
	12 pm – 2:00 pm	Poster Session	ASA, ENAR, WNAR, IMS, SSC, SPES, Q&P
	2 pm – 3:50 pm	Issues in the Sampling of Solids, Liquids, and Gases	Topic Contributed Session (SPES)
	2 pm – 3:50 pm	Robust Experimental Design	Topic Contributed Session (Q&P)
	2 pm – 3:50 pm	Quality System Topics: Process Control to Quality Standards	Contributed Session (Q&P, SPES)
Tuesday August 7	8:30 am – 10:20 am	Applied Statistics in the Microelectronics Industry	Invited Session (Q&P, SPES))
	8:30 am – 10:20 am	Statistical Challenges in the Telecommunications Industry	Topic Contributed Session (Q&P, SPES)
	8:30 am – 10:20 am	Analysis of Lifetime and Failure Data	Contributed Session (SPES)
	10:30 am – 12:20 pm	Data Integration	Invited Session (SPES)
	12 pm – 2:00 pm	Poster Session	ASA, ENAR, WNAR, IMS, SSC, SPES
	12:30 pm – 2 pm	Roundtable Luncheons	Q&P
	2 pm – 3:50 pm	Technometrics Invited Paper Session	Invited Session
	4 pm – 5:50 pm	Deming Lecture	Invited Session (ASA)
	5:30 pm – 7:30 pm	SPES/Q&P Members Meeting and Mixer	Open Meeting (SPES, Q&P)
Wednesday August 8	8:30 am – 10:20 am	Optimization in Statistics	Invited Session (Q&P, SPES)
	8:30 am – 10:20 am	Modeling and Bounding Techniques	Contributed Session (SPES, Q&P)
	10:30 am – 12:20 pm	Managing Variation in the Information Age	Topic Contributed Session (SPES, Q&P)
	10:30 am – 12:20 pm	Methods for Multivariate Analysis & Process Control	Topic Contributed Session (Q&P)
	12 pm – 2:00 pm	Poster Session	ASA, ENAR, WNAR, IMS, SSC, SPES, Q&P
	12:30 pm – 2 pm	Roundtable Luncheons	SPES
	2 pm – 3:50 pm	Impact of Dispersion Effects in Analyzing Unreplicated Fractional Factorial Designs	Invited Session (SPES, Q&P)
	2 pm – 3:50 pm	Model Building Tools	Contributed Session (Q&P, SPES)
Thursday August 9	8:30 am – 10:20 am	Process Monitoring & Adjustment	Topic Contributed Session (Q&P)
	8:30 am – 10:20 am	Computational Experiments and Studies	Contributed Session (SPES, Q&P)
	10:30 am – 12 pm	Applied Statistics in the Microelectronics Industry	Invited Session (Q&P, SPES)
	10:30 am – 12:20 pm	Wavelet and Time-Dependent Data Analysis	Contributed Session (SPES)

First section listed is primary sponsor. Second section is co-sponsor.



SPES Program News for JSM 2001 Atlanta

Joanne Wendelberger, Los Alamos National Laboratory, SPES Program Chair

The theme for JSM 2001 Atlanta is "Statistical Science for the Information Age." The SPES program includes a variety of sessions featuring innovative applications and methodological advances.

SPES will be the primary sponsor for 3 invited sessions:

Dimension Reduction for Simulation Science Data

George Ostrouchov, Oak Ridge National Laboratory has put together an exciting session addressing the challenges associated with large datasets generated in simulation studies. Participants are Chao Yang, Lawrence Berkeley National Laboratory, and Edward Wegman, George Mason University, and Leslie Moore, Los Alamos National Laboratory, and discussant Val Fedorov, SmithKline Beecham Pharmaceuticals.

Data Integration

Art Fries, Institute for Defense Analysis, has organized a session on the emerging area of Data Integration that will include presentations by Fred Hulting from Pillsbury, Alyson Wilson from Los Alamos National Laboratory, and Hien Tran from the California Air Resources Board.

Impact of Dispersion Effects in Analyzing Unreplicated Fractional Factorial Designs

Dennis Lin has organized this invited session in the ever important area of design and analysis of experiments where both location and dispersion are of interest. This session includes speakers William Brenneman, Procter and Gamble, Richard McGrath, Bowling Green State University, and discussant Guohua (James) Pan, Oakland University.

SPES is also cosponsoring the following invited sessions:

The Technometrics Invited Session

Generalized Linear Models in Industry: Design and Analysis, sponsored by Q&P

Optimization in Statistics, sponsored by Q&P

Applied Statistics for Microelectronics Industry, sponsored by Q&P

SPES will be hosting two topic contributed sessions:

Topics in Sampling Solids, Liquids, and Gases

Organized by Patricia Smith, Alpha Stat Consulting, this session examines problems faced in a variety of physical sampling situations. Session participants include Patricia Smith, Jeffrey Myers, Richard Bilonick, Evan Englund, and Lynn Vanatta, Air Liquide

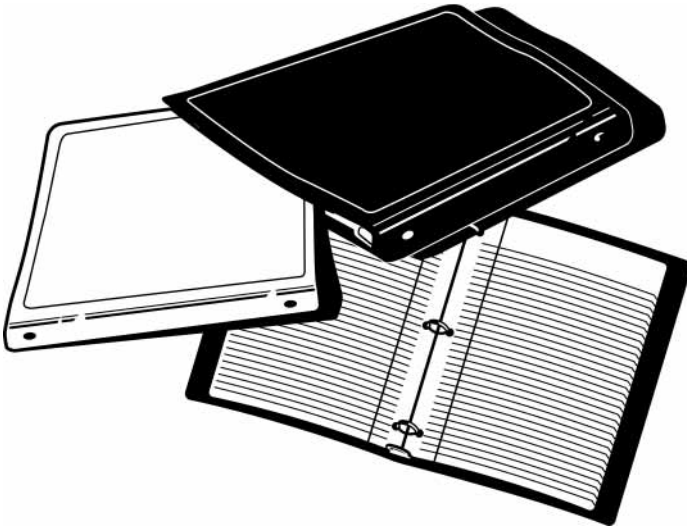
Managing Variation in the Information Age

This session, organized by Todd Graves features innovative approaches to the statistical treatment of variation in a diverse set of applications. Speakers include Michael Wincek, Stacey Hartley, David Banaszak, Lorraine Denby, and Gennadiy Gorelik. SPES is cosponsoring a Q&P Topic Contributed Session on Robust Experimental Design.

The SPES contributed program features a session on Experimental Design Strategies dedicated to the memory of Oscar Kempthorne. Other contributed sessions include presentations on Modeling and Bounding Techniques, Analysis of Lifetime and Failure Data, Computational Experiments and Studies, and Wavelet and Time-Dependent Data Analysis. SPES is co-sponsoring Q&P contributed sessions on Reliability and Failure Analysis, Quality System Topics, and Model Building Tools

SPES poster presenters will be presenting their work in the 3 joint-sponsored poster sessions to be held on Monday, Tuesday, and Wednesday from 12:00 to 2:00. Be sure to take this opportunity for direct interaction with your SPES colleagues participating in the poster sessions.

The SPES Roundtable Luncheons and the SPES Mixer/Business Meeting provide additional opportunities to meet and eat with your SPES colleagues!



You Might Have Missed...

Esteban Walker, University of Tennessee, Editor

Binder, R. V., "Can a Manufacturing Quality Model Work for Software?", September/October, 1997, IEEE Software, p. 101. The article begins with a fairly detailed explanation of the meaning of "Six Sigma" from a purely statistical point of view, based on the capability of a process. Using this narrow definition of Six Sigma, the article proceeds to enumerate the reasons why six sigma is not a good "model" to be used in the software industry. The author has some good points when he talks about the problems associated with measuring quality in software. For example, he mentions: "...Attempts to measure the extent of faults in software, by testing, are weak estimates." Using the software industry measure of reliability called failures per KLOC (thousand lines of code), and a literal interpretation of six sigma the author concludes that it means "...no more than 3.4 failures per million lines of code (0.0034 failures per KLOC). This would require a software process that is roughly two orders of magnitude better than current practice." This article points to the fact that "six sigma" is not a well defined concept. A "six sigma company" certainly does not mean that all their processes are six sigma capable, but that it is concerned about quality and makes continuous improvements to its processes. The author recognizes this problem of interpretation and points out that some organizations use "six sigma" simply as a slogan and not as a precise goal. For the most part, "Six Sigma" is the latest version of a quality movement that has been called things like TQM, SPC, Process Improvement, etc. The problem with the name of this latest version is that it can be taken too literally. (reviewer: Esteban Walker).

De Mast, J., Werner A. J. Schippers, Ronald J. M. M. Does and Edwin R. Van Den Heuvel, "Steps and Strategies in Process Improvement," Quality and Reliability Engineering International, 2000, volume 16, pages 301 – 311. This article has as its purpose giving an

overview and comparison of what the authors view as improvement strategies for using statistical methods in quality improvement projects. The four basic strategies reviewed are: SPC (on-line), Taguchi Methods, Shainin Methods, and Six Sigma Methods. The authors provide brief descriptions of their understanding of these four strategies. They provide two tables which will doubtless be useful for those not familiar with all four of these general improvement strategies – the first being a "Global comparison of the strategies," and the second a brief summary of the "Steps of the four selected strategies."

While believing that the authors have made a contribution which will be useful for those not familiar with all four of these strategies, this reviewer would like to point out a few particulars which may not be clear to those very ones for whom the authors' contribution will be most useful.

1) SPC (on-line) is hardly a high level strategy for process improvement, in the form which the authors describe it. Although the authors indicate that "the term SPC was used later on in senses encompassing a larger scope of quality control methodologies," it is still unfortunate that they confine their focus to "on-line SPC (as opposed to off-line SPC)." This restriction makes the methods of what they term "SPC (on-line)" hardly comparable to those of the other three strategies, all of which explicitly allow for some form of off-line experimentation (by whatever name). This reviewer does not know of anyone who would seriously claim to confine their improvement strategy to SPC (on-line) as the authors describe it. SPC, more broadly understood, would contain a variety of methods for understanding the sources of variation, their magnitude, and their effects on significant performance issues. These methods inevitably employ substantial off-line analysis.

2) Six Sigma strategies are not sufficiently differentiated by the authors from the other three. These improvement strategies are intimately woven in with specific management methodologies for managing company-wide quality improvement. Though the authors acknowledge this in part in their next to last paragraph in the section on "Six Sigma," they fail to properly acknowledge that this difference makes "Six Sigma" not really comparable with the other three methods, any more than hammering or deskmaking is comparable with carpentry. Both are possible subprocesses of carpentry – not things to be properly compared with carpentry.

This being said, there is still much which may be found useful in the paper, much of it summarized in the Tables described above. It is to this detail, particularly in section 4 of the paper, that we would point the reader interested in deriving maximum value from this interesting paper. (reviewer: William Parr).

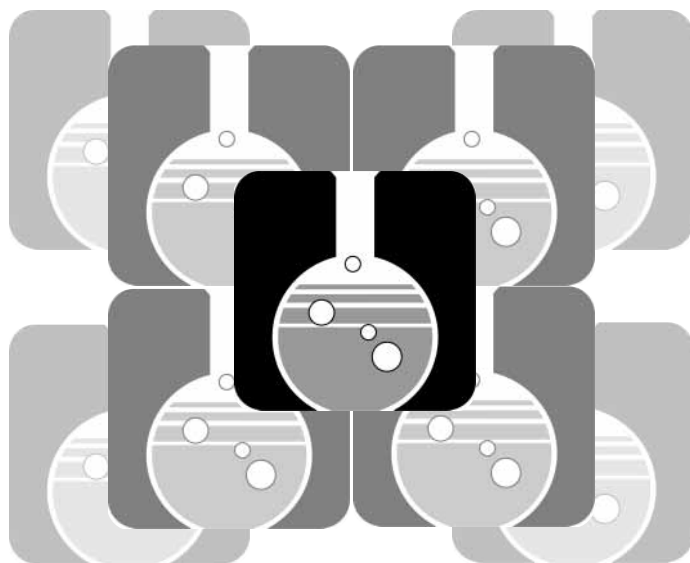
SPES Young Investigator Awards - - Roundtable Luncheons in Atlanta

SPES will host five roundtable luncheons at the Atlanta meetings in August. We have lined up some great discussion leaders, and lively exchanges are sure to take place.

We are again offering Young Investigator Awards to pay the price of a SPES luncheon for 10 students attending the meetings. Students interested in applying for an award should contact Russ Lenth for more information--- as soon as possible. He can be reached by email at russell-lenth@uiowa.edu, phone at 319/335-0814, or regular mail at Department of Statistics, University of Iowa, Iowa City, IA 52242.

The discussion leaders and topics are:

- **Edward Bedrick**, University of New Mexico, "Applications of Functional Data Analysis" -- Participants will discuss methods for discriminating among groups based on curve data. Data from an aircraft flight simulation will be used to motivate the discussion. Attendees will be encouraged to give their thoughts on possible approaches to the problem.
- **William Brenneman**, Procter and Gamble, "How to View Dispersion Analysis Results from Unreplicated Fractional Factorial Experiments" -- Current research has shown that there are fundamental problems with dispersion analysis from unreplicated fractional factorial experiments. These issues will be presented informally, and the way we view the results from such experiments will be discussed. Also to be considered is how to use these limited results to find guidance for further experimentation.
- **Shane Reese**, Los Alamos National Laboratory, "Bayesian Hierarchical Modelling for Industrial Applications" -- Bayesian hierarchical models are permeating almost every application area of statistics. They provide not only powerful analysis tools, but are also helpful because they explicitly include engineering knowledge and expert judgment. Furthermore, they provide a nice mechanism to communicate results of sometimes complex analyses.
- **Bill Notz**, Ohio State University and Editor of *Technometrics*, "Publishing Statistical Applications" -- We will discuss applications papers as motivators for new statistical methodology. We will address issues such as key ingredients, benefits to a variety of readers, and stimulation of future developments, both in generality and with reference to specific papers having applications in physical, chemical, and engineering sciences.
- **Lonnie Vance**, General Motors, "Statistical Issues in Product Warranty and Reliability" -- Reliability, warranty, and field data collected early in a product's life cycle are often used to predict future values. Discussion will examine techniques and methods used for such analyses.



Gordon Research Conference 2001

Randy Tobias, SAS Institute

Just a few weeks now until the next Gordon Research Conference on Statistics in Chemistry and Chemical Engineering! On July 22-27, 2001, statisticians, chemists, and engineers from industries and universities all over the world will meet at Williams College in Williamstown, Massachusetts, to discuss the latest research directions in applied statistics and the analysis of chemical phenomena. Now that this prestigious and popular conference is on a biennial schedule, this will be your last chance to attend until 2003. Check out the exciting program on the conference Web site <http://www.asapes.org/GRC2001.htm>, where you'll also find an "Apply On-line" link that you can use to apply to register. Get your application in as soon as possible. Although the meeting is open to all interested parties, the number of conference attendees is limited in order to promote maximum interaction.

In addition to the presentations, this conference also offers a poster session. Keep in mind this opportunity to discuss your research with other people who work in the multidisciplinary arena of statistics in chemistry and chemical engineering. Further, it is an excellent way to involve young researchers in this prestigious conference.

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Radial Basis Function Neural Networks

Robert G. Wilkinson
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1. Introduction

Radial basis function (RBF) neural networks are one of the most commonly applied types of neural networks in use today. When compared to the more traditional feed-forward backpropagation neural network, the RBF network has the advantage that linear fitting methods can be used to compute the unknown weights, allowing simpler and quicker estimation of the parameters of the network (i.e., training of the network). RBF networks have been applied successfully to a wide range of prediction and classification problems. From a theoretical perspective, the RBF network is a universal approximator (Park and Sandberg 1993). In summary, RBF networks are powerful and relatively easy to use additions to a modeler's toolkit.

To understand RBF networks, consider modeling the output of some process as a function of p inputs (assumed to be centered and scaled to have mean 0 and variance 1). A simple RBF network would model the i th output as a weighted sum of q radial (symmetric) basis functions,

$$\hat{y}_i = \sum_{j=1}^q w_j \phi(\mathbf{x}_i; \mathbf{c}_j, r_j) \quad (1.1)$$

Here, ϕ is the suitably chosen radial basis function and \mathbf{x}_i is the p -dimensional input vector corresponding to output y_i . If the basis functions were chosen to be Gaussian, we can rewrite (1.1) as

$$\hat{y}_i = \sum_{j=1}^q w_j \exp(-(\mathbf{x}_i - \mathbf{c}_j)'(\mathbf{x}_i - \mathbf{c}_j)/r_j) \quad (1.2)$$

The parameters \mathbf{c}_j (p -dimensional vector) and r_j (scalar) determine the center and width of the j th basis function. Although the w_j are typically referred to as the RBF weights, another way of viewing the RBF network is to consider the w_j as signals centered at the \mathbf{c}_j , and the prediction \hat{y}_i as the (radial) weighted sum of those signals. In the neural network community, a RBF network is thought of as a simple two layer network employing a radial basis activation function.

A useful enhancement to the model described above is to add linear terms to the RBF network, i.e.,

$$\hat{y}_i = \mathbf{b}_0 + \mathbf{b}'\mathbf{x}_i + \sum_{j=1}^q w_j \exp(-(\mathbf{x}_i - \mathbf{c}_j)'(\mathbf{x}_i - \mathbf{c}_j)/r_j) \quad (1.3)$$

where \mathbf{b}_0 is the intercept (scalar) and $\mathbf{b} = (b_1, \dots, b_p)'$ is a p -dimensional vector of coefficients. The model in (1.3) is a combination of linear terms, and higher order (RBF)

terms. As such, hypothesis testing could be performed to determine whether the surface is non-linear, i.e., whether the RBF terms are needed or not.

To train the RBF network, appropriate values for the number of basis functions (q), the basis function centers (\mathbf{c}_j) and widths (r_j) need to be specified. Once this is done, linear estimation approaches can be used to estimate the linear coefficients (\mathbf{b}_0 and \mathbf{b}) and the RBF weights (w_1, \dots, w_q). The most straightforward method of determining q and \mathbf{c}_j would be to define a radial basis function at each distinct input vector in the training set. Alternatively, a clustering algorithm (e.g., K-Means) could be employed on the input vectors of the training data; basis functions would then be defined at the cluster centers.

Many different heuristic approaches have been proposed for specifying the RBF widths r_j . From my experience, I have found making r_j proportional to the sum of the squared differences between the RBF center \mathbf{c}_j , and the input vectors works well,

$$r_j = k * \sum_{i=1}^n (\mathbf{x}_i - \mathbf{c}_j)'(\mathbf{x}_i - \mathbf{c}_j) / n \quad (1.4)$$

Here n is the number of training samples and k is a tuning constant.

Once the radial basis functions have been fully specified, all that remains is to estimate the linear regression coefficients ($\mathbf{b}_0, \mathbf{b}, w_1, \dots, w_q$). In the simplest case, this could be accomplished using ordinary least squares. However, if the number of basis functions (q) is close to the number of data points (n), the potential for overfitting becomes great. One way to address this issue is to use subset selection techniques to select the "best" subset of basis functions. Alternatively, regularization could be applied to improve generalization properties of the network. In regularization, the linear regression coefficients are estimated by minimizing a penalized error sum of squares, e.g.,

$$\sum_{i=1}^n (y_i - f(\mathbf{x}_i))^2 + \lambda_1 \sum_{j=1}^q w_j^2 + \lambda_2 \sum_{j=1}^p b_j^2 \quad (1.5)$$

Here, λ_1 and λ_2 are regularization parameters that determine the amount of the penalty, larger values corresponding to more shrinkage of the estimated coefficients towards zero. Regularization can be accomplished via ridge regression, or by a more formal Bayesian analysis.

2. Example

As an illustration of the application of RBF networks, consider the following nonlinear function given in Hwang, Lay, Maechler, Martin, and Schimert (1994) and also in Holmes and Mallick (1998).

$$f(x_1, x_2) = 1.9 [1.35 + \exp(x_1) \sin\{13(x_1 - 0.6)^2\} \exp(-x_2) \sin(7x_2)] \quad (2.1)$$

A graph of this function is shown in Figure 1.

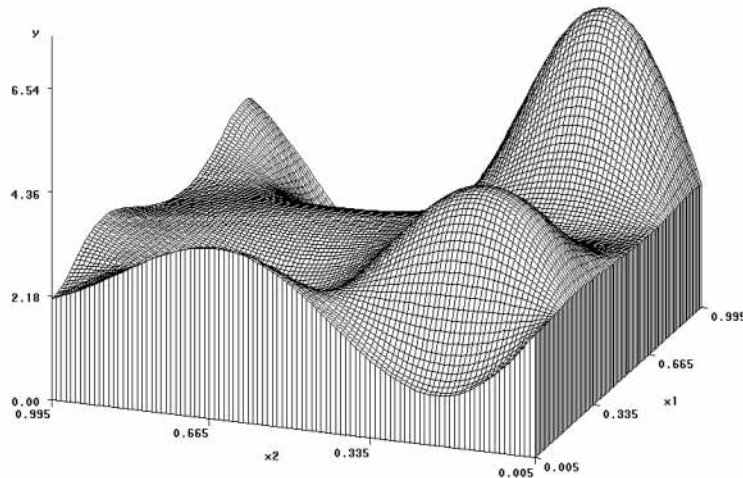


Figure 1. True Surface of Function Being Modeled

A training data set consisting of 225 data points, where (x_1, x_2) is distributed uniformly on the unit square, was created. For the response variable, normally distributed white noise (mean 0, standard deviation 0.25) was added to the function above. In order to model this data, RBF centers were located at each data point in the training set. With regards to the RBF widths, several different values for k in equation (1.4) were tried, with the value of $k=0.08$ selected by 10-fold cross validation. Finally, a Bayesian approach was used to estimate the RBF weights and linear term coefficients. Prior distributions were put over the coefficients, sampling variance, and the regularization parameters. Since there doesn't exist a conjugate prior distribution for the regularization parameters, the Gibbs sampler was employed to assist in computing the posterior distributions. For further details on Bayesian modeling in linear models, see Meyer and Wilkinson (1998).

Figure 2 contains a plot of the predicted values from the RBF network. As you can see the RBF model fits this complex function rather well.

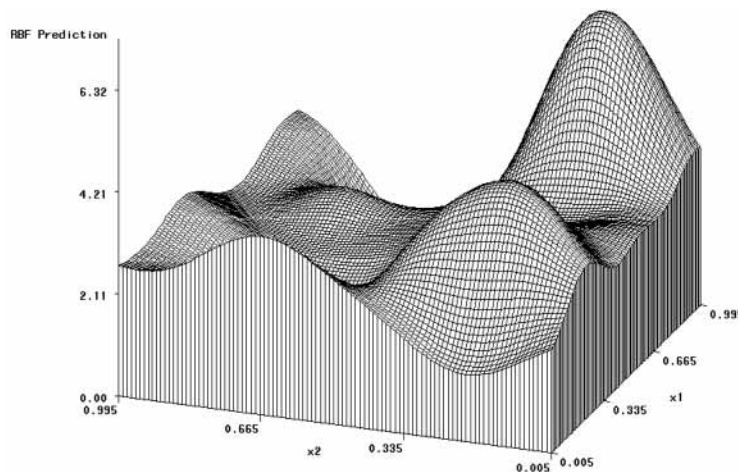


Figure 2. Predicted Values from the RBF Network

3. Summary

A high-level overview of RBF neural networks has been presented. The RBF network is a flexible and powerful tool for modeling complex relationships. An advantage of this type of neural network is that once the RBF centers and widths have been specified, linear modeling approaches can be used to determine the weights of the network.

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Gerry Hahn

2001 Deming Lecture

Don Richter

Gerry Hahn will present the sixth Deming Lecture, Tuesday, August 7, 2001, at 4 p.m. at the Joint Statistical Meetings in Atlanta, Georgia. The award honors the accomplishments of Dr. W. Edwards Deming, recognizes the accomplishments of the lecturer, and enhances the awareness among the statistical community of Deming's philosophy and methods. Gerry will talk about "The Proactive Statistician." He will examine how the role of the statistician has evolved in the years since Deming's death in 1993, and how his teachings have fared over the years. Gerry will conjecture on how Deming would have reacted to today's environment in general, and to the Six Sigma initiative in particular. He will stress that it is essential for today's statistician to play a proactive role, and will elaborate on this idea in the context of new product development.

In 1955, Gerry joined the GE Company as an applied statistician in what was to become the company's Research and Development Center. He found a home at GE R&DC, working there for over 46 years. In 1973, Gerry established the Center's Applied Statistics Program. Under his leadership, the group grew from the original staff of four to its current 18 statistical professionals. The Program is a recognized world leader in advancing quality and productivity improvement in all of GE's businesses. Gerry will be retiring from GE in May, 2001.

Gerry is a Fellow of both ASA and the American Society for Quality (ASQ) and is an elected member of the International Statistical Institute (ISI). Gerry is the author of over 100 papers in the engineering and statistical literature, and has given over 150 invited presentations. In 1992, he won the Shewhart Medal, ASQ's highest technical honor, "for outstanding contributions and demonstrated leadership in the science and techniques of quality control and applied statistics; his proactive role in fostering Total Quality Management; and, his dedication as a pioneer in the quality revolution." Gerry is also a three-time winner of ASQ's Brumbaugh Award for the "paper judged to have made the largest contribution to the development of industrial applications of quality control," a two-time winner of both ASQ's Shewell Prize and its Wilcoxon Prize, and the recipient of the Jack Youden Prize, the William G. Hunter Award, the Chicago Chapter ASA Outstanding Statistician Award, and the Deming Medal, and of ten other citations from ASA, ASQ and the Operations Research Society of America.

Q&P Short Courses in Atlanta

TEACHING AN INTRODUCTORY STATISTICS COURSE BASED ON STATISTICAL THINKING

G. Rex Bryce - Brigham Young University

Roger Hoerl - General Electric Company

Ron Snee - STBI

Much of the current discussion regarding making fundamental changes to introductory statistics courses centers around the need to focus more on conceptual understanding of key concepts and less on formulas and calculations. This workshop, based on a new text by Hoerl and Snee, will present a recommended solution for implementing the required changes, without spending a large amount of time redesigning the course from scratch or developing materials. Results from a pilot course using the text at Brigham Young University will be presented. The text is oriented towards a business context, but can be used for other contexts as well, such as general or engineering statistics.



ANALYZING FRACTIONAL FACTORIAL EXPERIMENTS IN THE PRESENCE OF DISPERSION

Dennis K.J. Lin, Penn State University

Richard N. McGrath, Bowling Green State University

In fractional factorial designs, factors influencing dispersion are important to study not only because they are interesting in and of themselves but also because they impact inferences on location effects. In this course, participants will learn how dispersion effects impact location effect identification, and how location effects impact dispersion effect identification. It will be shown how to remove the confounding between dispersion and location effects through partial replication of the experiment or through a newly developed test. State-of-the-art techniques will be discussed and employed and participants will receive software to perform analyses.

David Bacon Receives ASQ Statistics Division's Hunter Award

The 2000 William G. Hunter Award was presented to David W. Bacon at the Fall Technical Conference (FTC) in Minneapolis, MN. The Statistics Division of the American Society for Quality (ASQ) established the Hunter Award in 1987 in memory of the Division's founding chair to promote, encourage and acknowledge outstanding accomplishments during a career in the broad field of applied statistics. The attributes that characterize Bill Hunter's career - consultant, educator for practitioners, communicator, and integrator of statistical thinking into other disciplines - also characterize Dave's career.

At the award presentation, Dave was described as follows: Throughout his career, Dave has integrated statistical thinking and methods into numerous areas of science and engineering through his teaching, research and administration. After completing his PhD in statistics at the University of Wisconsin, where he was a colleague of Bill Hunter, he joined DuPont Canada. In 1968, Dave returned to academia as an Associate Professor in the Department of Chemical Engineering at Queen's University. There he excelled as an instructor in the classroom and in a mentoring and tutoring role. His research contributions focusing on the development and application of statistical methods to chemical engineering problems have been published in an array of journals. Dave's career at Queen's went beyond the Department of Chemical Engineering when he served as Dean of Applied Science. His excellent communication skills allowed him to serve in this capacity with distinction for more than 10 years. Dave's accomplishments are not limited to Queen's University. He has developed and presented short courses in statistical methods internationally. He has consulted with companies in numerous industry sectors. Since his early retirement from Queen's University in 1999, Dave has been working as a consultant in Six Sigma.

Dave made the following remarks when he accepted the award:

"I want to begin by expressing my deep appreciation to the Hunter Award Committee of the Statistics Division of ASQ for this significant honor. I also wish to thank Tom Harris and John MacGregor, and others who nominated me for this award, along with those who provided additional support.

It is a humbling experience to review the list of previous recipients of the William G. Hunter Award. I am privileged to join their company.

This award has very special significance for me since, as some of you know, Bill Hunter and I were graduate students together in the early 1960s in what was then a newly established Department of Statistics at the University of Wisconsin in Madison. I would like to take a few minutes to share my recollections of Bill Hunter the statistician and Bill Hunter the man.

Bill began his graduate studies in Madison one year before I did, and he completed his program two years

before me. This was an early indication of Bill's talent for leading the way for other aspiring statisticians.

He and I shared an apartment for eight months or so, and that was a truly memorable experience. He had some unique tastes, beginning with the stimulating art of the Swiss painter Paul Klee, and a fascination with military march music, especially at 6 o'clock in the morning. He introduced me to a new breakfast dish - dollops of ice cream topped with wheat germ. And I will never forget our regular nightcaps of Black Russians - we slept very well!

Even as a graduate student, Bill displayed many of the characteristics that set him apart as a superb practicing statistician. Above all, statistics was FUN for Bill, and the joy he generated in his professional activities (and in his leisure activities) was infectious to anyone who were lucky enough to be associated with him.

A few of you here today, such as Lynne Hare, Jim Lucas and Steve Bailey, who attended the Gordon Research Conferences on Statistics in Chemistry and Chemical Engineering in the "old days", when Bill created and performed his unique skits can attest to his rich and uninhibited sense of humor.

His creative use of GRAPHICAL SUMMARIES was another of his distinguishing traits. I still have one or two of his wonderful doodles that he composed during lectures that we attended together.

Bill's appetite for VARIETY in statistical challenges set a marvelous example for his colleagues and the many students from diverse fields of study whom he taught. Like our mutual Ph.D. supervisor, George Box, Bill shared his rich and varied consulting experiences from industry, government, and the academic world freely with anyone who showed interest.

His achievements as an educator, both within the university and beyond, are legendary. How many people teaching design of experiments have been stimulated by the 101 examples of designed experiments developed and conducted by Bill's students, which he summarized in a brief but wonderfully useful Technometrics paper many years ago?

In summary, Bill Hunter was the epitome of a professional statistician - brilliant, creative, inspiring, hilarious and kind. And he was an exemplary human being. I am truly honored to receive this award which bears his name."

The committee is soliciting nominations for 2001. Nominations must be received by June 30, 2001. Forms for the 2001 award are available from the William G. Hunter Award Committee Chair:

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David Bacon

It's Still Statistics & Quality: Challenges Old and New

(2001 Fall Technical Conference)

SPES is proud to co-sponsor the 45th Annual Fall Technical Conference, with the theme of "It's Still Statistics & Quality: Challenges Old and New," to be held October 18-19, 2001 at the Royal York Hotel in Toronto, Ontario. The technical program has been chosen. The titles of some of the presentations are

- "50th Anniversary of Response Surface Methodology" with:
 - (a) A videotape presentation by Dr. George E. P. Box, directly followed by
 - (b) An Invited Panel Discussion, with Discussants: Norman Draper, J. Stuart Hunter, Raymond H. Myers, Andre Khuri, John Cornell, and Douglas C. Montgomery
- "Graphical Design Evaluation Techniques for Constrained Mixture Experiments"
- "Quality Improvement of Administrative and Service Processes"
- "Genetic Algorithms for the Construction of D-efficient Designs"
- "Supersaturated Response-Surface Designs"
- "Calculation and Comparison of Three Weibull Models"
- "A Case Study for Control Charting a Product Quality Measure that is a Continuous Function over Time"
- "New Second-Order Designs"
- "Quality Oriented Maintenance for Manufacturing Processes"
- "Multivariate Process Monitoring: The 'Preprocessing' Challenge"
- "Establishing Multivariate Specification Regions for Incoming Materials"
- "An Approach to a Simple Statistically Valid Alternative to Process Capability Indices: Part II"
- "Experiments for Assembled Mechanical Products"
- "The Crucial Role of Optimization in Statistical Control of Technological Processes"
- "A New Approach for Screening Many Factors: TSP"
- "Multivariate Control Charts for Discrete Data"
- "Projection-based Screening Design and Analysis"
- "Some Difficulties in Analyzing Plackett-Burman Designs with Interactions"
- "Multivariate Batch Process Monitoring"

- "Variance Component Calculations: Common Methods and Pitfalls"
- "Statistical Evaluation of Material Aging and Degradation"
- "Enhanced Analysis of Factorial Designs with Regression Trees"
- "Economic Plans for Reliability Demonstration and Estimation Using Tail Testing"
- "Robust Product Design to Minimize Counted Defects"

Visit the SPES Web page at www.amstat.org/sections/SPES for available information about the program. Updates and additional information about registration, short courses, and the non-technical program will be available in the near future.

2001 SPRING RESEARCH CONFERENCE

This year's SRC will be held June 18-20 in Roanoke, VA, and is being hosted by the Statistics Department of Virginia Tech.

The 2001 SRC will feature a keynote address by Henry Wynn of Warwick University, entitled "Accelerating Industrial Statistics". Other plenary speakers at the conference are Stephen Fienberg (Carnegie Mellon University), John Schultz (University of Virginia), Nell Sedransk (National Institute of Standards and Technology), and Ernest Seglie (US Department of Defense). Invited paper sessions have been organized around a number of important themes including analysis of data generated by communications networks, knowledge and data integration in complex settings, and experimental design issues specific to the biopharmaceutical industry, as well as more traditional topics such as system reliability, and statistical process control. Two further invited sessions feature recent outstanding papers from Technometrics and ongoing research projects at the National Institute for Statistical Sciences, respectively. In addition, a number of contributed paper sessions feature submissions motivated by problems from a wide variety of important applications areas.

Further information on the 2001 SRC, including a preliminary conference schedule, abstracts of talks to be presented, and links to register for the conference and lodging, are available through the conference Web site at <http://www.public.iastate.edu/~stat/conference/content.html>.

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