

QRE CENTER NEWSLETTER

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Spring

Quality & Reliability Engineering (QRE) Center

NSF/Industry/University Cooperative Center - Rutgers University & Arizona State University

QRE Projects List

1999	QRE99-001	Product Testing and Process Control In a Multistage Production System	Susan L. Albin
	QRE99-002	Reliability Prediction Based on Degradation With Multiple Changing Stresses	David W. Coit
	QRE99-003	Optimal Allocation of Stress Levels & Sample Sizes in Accelerated Life Testing	Elsayed A. Elsayed
	QRE99-007	Process Capability Indices for Normal and Nonnormal	Douglas Montgomery J. Bert Keats
	QRE99-008	Hybrid Acceptance Sampling Plans	Doug Montgomery Connie M. Borrer
1998	QRE98-001	Control of the Startup Period in Batch Processing	Susan L. Albin
	QRE98-002	Reliability Modeling for Aging Under Multimodel Stress Levels	Ron Askin
	QRE98-003	Repairable Systems Reliability: Planning and Assessment Tools	David W. Coit
	QRE98-004	A General Reliability Model for Accelerated Life Testing: Statistics- Physics Relationship and Experimentation	Elsayed A. Elsayed Jian Zhao
	QRE98-005	Process Monitoring and Control: Low PPM Rates	J. Bert Keats Douglas Montgomery
	QRE98-006	Statistical Methodology for Characterization, Control & Optimization Of Industrial Processes	Douglas Montgomery J. Bert Keats
	QRE98-007	Determining Quality Protection When a Sequence of Samples or Units are Inspected	Douglas Montgomery J. Bert Keats
	QRE98-008	IC Manufacturing Process Control	George Runger Douglas Montgomery
	QRE98-009	A General Reliability Model for Combined Hardware and Software Systems	Hoang Pham
1997	QRE97-001	Multivariate Control of Batch Processes	Susan L. Albin
	QRE97-003	System Reliability Models with Uncertain Component Reliability Estimates	David W. Coit
	QRE97-004	A General Reliability Model for Accelerated Life Testing	Elsayed A. Elsayed
	QRE97-005	Electronic Manufacturing Processes and Reliability	J. Bert Keats
	QRE97-007	Statistical Methods for New Product and Process Development	Douglas Montgomery
	QRE97-008	Multivariate Process Monitoring and Control	Douglas Montgomery
	QRE97-009	A Software Reliability Model with Final Environmental Factors	Hoang Pham

COLLABORATION BETWEEN QRE AND CAVE CENTERS

Relating Field Data to Accelerated Life Testing

The Center for Advanced Vehicle Electronics (CAVE) of Auburn University will partner with the Quality and Reliability Engineering (QRE) Center of Rutgers University and Arizona State University to investigate the relationship between wear, degradation and failure of vehicle controllers as experienced in the field with that expected by the results of ALT conducted in the laboratory. CAVE and QRE have jointly submitted a proposal to NSF to pursue this important research. This project brings together two centers to improve accelerated life testing (ALT) methods. DaimlerChrysler Electronics of Huntsville, Alabama supplies the test bed.

Vehicle electronics are subject to stress due to temperature, humidity, cycling and other environmental hazards. The materials that comprise the controllers are susceptible to the effects of corrosion and oxidation. The solder that connects the controller components can crack due to fatigue and creep under high temperature and thermal cycling stresses. These failures affect the performance of the vehicle from slightly to severely. This project will develop a general methodology for specifying accelerated life tests so that they result in an accurate characterization of the degradation and failures that will be experienced in the field. The failure mechanisms for the assembly materials in field units will be investigated in the development of the accelerated life tests.

This research project involves the natural synergy of two research centers whose expertise is required for the successful completion of this project. By using the capabilities from different centers to support project objectives, research findings can be efficiently transitioned to support member companies objectives. The QRE center has experts in accelerated life modeling and CAVE has the required testing equipment and in-depth knowledge of automotive electronics needed to assure successful technology transfer.

North Jersey ASQ Spring Quality Conference

The North Jersey ASQ Spring Quality Conference 2000 will be held on Tuesday, April 11, 2000 8:00 a.m. to 4:00 p.m. The conference theme will be "Quality for the 21st Century." The conference will be held at the Parsippany Hilton, off Route 10 West. Workshop and session topics include: FDA Track, Six Sigma Quality, ISO 9000 Revisions, TL 9000, ISO 14000, Process Audits, Teaming, Software quality, Data Mining, Bench Marking, Problem Solving, QFD/SPC. For additional information, contact Bob Braun at (908) 852-3509

QRE Center Involved at 2000 RAMS Symposium

The 2000 Annual Reliability and Maintainability Symposium (RAMS) has held in Los Angeles, CA on January 24-27, 2000. This years theme was *Advancing the Technology - A Commitment to Lifelong Learning*. The symposium was attended by over 500 people, representing many different industries and nations. Many QRE members were present and actively participated at RAMS this year.

QRE members serving as session moderators were

- **Richard Rudy**, *DaimlerChrysler*, R&M Techniques in the Commercial/Industrial Environment
- **Mike Tortorella**, *Lucent Technologies*, Design Techniques
- **Sid Markowitz**, *U.S. Army TACOM-ARDEC*, Risk Analysis
- **Paul Parker**, *Lucent Technologies*, Accelerated Life Testing
- **David Coit**, *Rutgers University*, Statistical Methods for R&M Analysis

Additionally, papers and/or tutorials were presented by **Ming Lu**, *DaimlerChrysler*; **Paul Parker**, *Lucent Technologies*; **Victor Loll**, *Nokia Mobile Phones*; **Mike Tortorella**, *Lucent Technologies*; **David Coit**, *Rutgers*.

U. S.-African University Collaboration

Susan Albin, *Rutgers University*, participated in a symposium entitled Developing Collaborative Africa-America Graduate Programs funded by the Agency for International Development and the Association Liaison Office for the purpose of exploring the potential for the development of joint Africa-America graduate programs. The Agency for International Development, through its University Development Linkages Program and through other initiatives has expressed a desire for the development of collaborative programs between U. S. and African universities, especially at the postgraduate level.

The conference was held in University of the Western Cape, Cape Town, South Africa on February 24-26, 2000, to initiate the process. There were 30 delegates from the US and approximately 60 delegates representing African universities.

The partner institutions will lead a process which will culminate in the implementation of several joint graduate degree programs. These programs will lead to degrees jointly awarded by at least one United States and one African university. Furthermore, it is expected that the programs will be conducted partially at each university, conceivably with distance education modalities, and using the faculty of both institutions.

Funding to Continue Repairable Systems Reliability Research

Prof. **David Coit** has been notified by the National Science Foundation (NSF) that he will receive an additional \$25,000 to continue research on repairable systems reliability. The funding will be a supplement to his NSF Grant, "Stochastic Optimization of System Reliability with Risk-Averse Decision Makers." This work will be a continuation of the completed project QRE98-003, "Repairable Systems Reliability: Planning and Assessment Tools."

The project will work to develop, test and automate enhanced confidence intervals for system failures based on superimposed subsystem failure patterns. The resulting software will run on Windows and will be available to QRE members.

Rutgers IE Department Working Paper Series

Rutgers' industrial engineering working paper series has been completed for 1999. Anyone desiring a copy of one of these papers should contact Cindy Ielmini at 732-445-3654 or ielmini@rci.rutgers.edu.

- 99-102 *System Reliability Optimization with k-out-of-n Subsystems*, D.Coit/J.Liu
- 99-105 *System Reliability Sensitivity Measures*, T.Jin/D.Coit
- 99-106 *Software Reliability and Cost Modeling by A Quasi Renewal Process*, H.Pham/H.Wang
- 99-107 *Optimum Initial Process Mean and Production Cycle for Processes with a Linear Trend*, J.Jang/D.Ahn/M.Lee/E.Elsayed
- 99-109 *Process Mean and Screening Limits for Filling Processes Under Two-Stage Screening Procedure*, M-K.Lee/E.Elsayed
- 99-112 *Signature Analysis and Defect Detection in Layered Manufacturing of Ceramic Sensors and Actuators*, T.Fang/M.Jafari/S.Danforth/A.Safari
- 99-113 *Reliability Estimation of Degraded Structural Components Subject to Corrosion*, M.Ettouney/E.Elsayed
- 99-114 *Multivariate Monitoring of Batch Process Startup*, R.Wurl/I.Shiffer/S.Albin
- 99-116 *On-Line Surveillance and Monitoring*, H.Jeong/E.Elsayed
- 99-117 *System Reliability Prediction Prioritization Strategy*, D.Coit
- 99-118 *Reliability Estimate using Degradation Data*, G.Eghbali/E.Elsayed
- 99-121 *Variance of System Reliability Estimates with Arbitrarily Repeated Components*, T.Jin/D.Coit
- 99-122 *Allocation of Test Units to Minimize System Reliability Estimation Variability*, T.Jin/D.Coit
- 99-123 *Genetic Algorithm to Maximize a Lower-Bound for System Time-to-failure with Uncertain Component Weibull Parameters*, D.Coit/A.Smith
- 99-125 *Software Reliability Models with Time Dependent Hazard Function Based on Bayesian Approach*, L.Pham/H.Pham
- 99-127 *Variance of Predicted Response as an Optimization Criterion in Multiresponse Experiments*, F.Fogliatto/S.Albin
- 99-128 *A Hierarchical Approach to Optimizing Descriptive Analysis Multiresponse Experiments*, F.Fogliatto/S.Albin/B.Tepper
- 99-131 *Considering Fault Removal Efficiency in Software Reliability Assessment*, X.Zhang/X.Teng/H.Pham
- 99-134 *Optimal Opportunistic Preparedness Maintenance of Multi-unit Systems*, H.Wang/H.Pham

Call for Participation

ISSAT International Conference on Reliability and Quality in Design

The sixth ISSAT International Conference on Reliability and Quality in Design will be held August 9-11, 2000 in Orlando, FL. The conference is an international forum for presentation of new results, research developments, and applications in reliability and quality in design. Pertinent topics include:

- Reliability
- Modeling Analysis and Simulation
- Fault Tolerance
- Quality Assurance
- Optimization
- Software Reliability and Testing

The conference general chair is **Hoang Pham**, Rutgers University, and the program chair is **Ming-Wei Lu**, DaimlerChrysler. To organize session or panel, contact Dr. Lu at (248) 576-0167 or Dr. Pham at (732) 445-5471.

The U.S.-East Asia Workshop on Engineering Systems and Applications

The U.S.-East Asia Workshop on Engineering Systems and Applications will be held April 5-7, 2000 in Ho Chi Minh City, Vietnam. The workshop will provide a forum in which researchers and practitioners from the United States and Vietnam can share the latest information technologies and research activities in every engineering discipline for enhancing the productivity of modern engineering systems in the 21st century. The workshop sponsor is the US National Science Foundation (NSF). The organizers are Rutgers University, Ho Chi Minh Institute of Technology and VIFON-COOK. For information, contact Hoang Pham, Rutgers University, at (732) 445-5471.

IERC Conference in Cleveland, May 21-23

The Industrial Engineering Research Conference (IERC) will be held on October 21 to 23 in Cleveland, OH. There will be numerous papers and technical presentations pertaining to quality and reliability. Papers to be presented by Arizona State or Rutgers are as follows.

1. *Engineering Systems Reliability Modeling*, **Hoang Pham, Xiaolin Teng**, Rutgers University
2. *Comparisons of Unreliability Estimates for use with Multiply-Censored Data in Probability Plotting*, **Katina Skinner, J. Bert Keats**, Arizona State University, **William J. Zimmer**, University of New Mexico
3. *Allocation of Test Units to Minimize the Variance of the System Reliability Estimate*, **David W. Coit, Tongdan Jin**, Rutgers University
4. *Confidence Limits on Reliability Estimates Using the Extended Linear Hazards Regression Model*, **Elsayed Elsayed**, Rutgers University
5. *Monitoring Automatically Controlled Processes With Step Input Disturbance Using Statistical Control Charts*, **Muge Gultekin**, Rutgers University **Elsayed Elsayed**, Rutgers University, **John R. English**, University of Arkansas, **Anna Soffia Hauksdottir**, University of Iceland
6. *New Sheet Metal Folding Processes*, **Daniel Kling, E. A. Elsayed**, Rutgers University
7. *Applying Methods of Approximation Theory to Multivariate Data Reduction*, **Lars Nordmann, James T. Luxhoj**, Rutgers University

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