Division Newsletter

May, 2023

QUALITY CONTROL & RELIABILITY ENGINEERING DIVISION

Newsletter Editors: *Saunak Panda, Dr. Aziz Ezzat, Dr. Xiaolei Fang, and Dr. Dan Li*

Message from the Division President

Dear fellow QCRE members,

I want to start by thanking each and every one of you for your continued support of our division. I would also like to acknowledge our sponsors, members, and friends, who have supported us in the past year by participating in various activities and providing us with valuable feedback. Your support and encouragement have been instrumental in helping us achieve our objectives and plan our activities. I continue to encourage all members to participate in our division's activities and contribute to its success.

First and foremost, I am thrilled to announce that our upcoming IISE Annual Conference and Expo is just around the corner. Our team has been meeting regularly and working tirelessly to bring you an event that is both informative and engaging. We have lined up an impressive roster of speakers and presenters, covering a wide range of topics that are sure to be of interest to everyone in our community. With 18 technical sessions, 6 special sessions (e.g., Best Track Paper, Best Student Paper, Data Challenge, Student Interaction and Poster Session), and around 90 presentations/invited talks, there will be plenty of opportunities to learn, connect, and engage with fellow professionals. Our town hall meeting, scheduled for Monday from 12:30 PM - 1:50 PM, is a particularly exciting event. This is your chance to hear more about our activities and initiatives and celebrate the winners of our competitions and awards. I encourage everyone to attend and show their support for our community.

I would also like to warmly welcome our new board members and president-elect to our division. We are fortunate to have such talented and dedicated individuals join us, and I am excited to see the impact that they will have on our division. I am confident that their expertise and experience will be invaluable as we continue to grow and expand our reach.

Please feel free to contact our leadership team if you are interested in organizing new activities or serving on division committees. We value your contribution to our growth and expansion, and look forward to your ideas and feedback. Thank you once again for your support and dedication to the QCRE division at IISE and hope to see you at the conference in New Orleans.

Sincerely,

Ramin Moghaddas

IISE QCRE Division President, 2022-2023

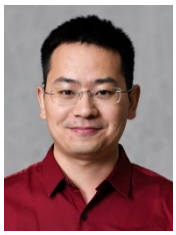
QCRE Board of Directors (2022-2023)

President: Ramin Moghaddass
University of Miami
ramin@miami.edu

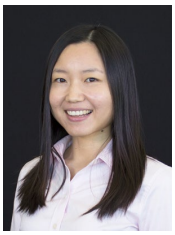
Past president: Linkan Bian
Mississippi State University
bian@ise.msstate.edu

President-elect: Yisha Xiang
University of Houston
yxiang4@uh.edu

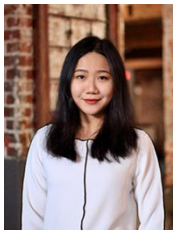
Board member: Ahmed Aziz Ezzat
Rutgers University
aziz.ezzat@rutgers.edu



Board member: Xiaolei Fang
North Carolina State University
xfang8@ncsu.edu



Board member: Na Zou
Texas A&M University
nzou1@tamu.edu



Board member: Dan Li
Clemson University
dli4@clemson.edu

Board member: Xiaowei Yue
Virginia Tech
xwy@vt.edu

Student board member:
Shancong Mou,
Georgia Tech
shancong.mou@gatech.edu

Student board member:
Saunak Panda,
University of Houston,
spanda@uh.edu

Congratulations to the new board members!

Board member: Chao Wang
The University of Iowa
chao-wang-2@uiowa.edu

Board member: Zimo Wang
Binghamton University
zimowang@binghamton.edu

Board member:
Mostafa Reisi Gahrooei
University of Florida
mreisigahrooei@ufl.edu

Board member:
Syed Hasib Akhter Faruqui
Virginia Tech
syedhasibakhter.faruqui1@northwestern.edu

2023 IISE Annual Conference & Expo QCRE Track Conference Highlights

Track Chairs: Dr. Xiaowei Yue, Dr. Yisha Xiang, and Dr. Ying Lin

# of accepted abstracts: **87**
# of accepted papers: **26**
# of presentations: **70**
# of sessions: **18** regular sessions and **6** special sessions

Special Sessions:

- QCRE Data Challenge Competition (Sunday, May 21st, 8:00AM-9:20AM)
- QCRE Best Student Paper Competition Session (Sunday, May 21st, 11:00AM-12:20AM)
- QCRE Best Track Paper Competition Session (Sunday, May 21st, 2:00PM-3:20PM)
- QCRE Student Interaction and Poster Session (Sunday, May 21st, 3:30PM-4:50PM)
- QCRE Town Hall Meeting (Monday, May 22nd, 12:30PM-1:50PM)
- QCRE Georgia Tech Research Advances Meeting (Monday, May 22nd, 02:00PM-3:20PM)

2023 IISE Annual Conference & Expo QCRE Award Finalists

- Finalists of the 2023 QCRE Best Track Paper Award

Co-chairs: Dr. Yisha Xiang & Dr. Ying Lin (University of Houston), Dr. Xiaowei Yue (Virginia Tech)

"Grouping and Spatially correlated Sparse Bayesian Learning with Application to Multi-Stage Assembly Systems"

Jihoon Chung and James Kong

Virginia Tech

"Graph-aware Tensor Topic Models for Individualized Passenger Travel Pattern Clustering"

Ziyue Li, Hao Yan, Chen Zhang, Andi Wang, Wolfgang Ketter and Fugee Tsung

University of Cologne (Universität zu Köln), Arizona State University, Tsinghua University, and Hong Kong University of Science and Technology

"RGI: robust GAN-inversion for mask-free image inpainting and unsupervised pixel-wise anomaly detection"

Shancong Mou, Xiaoyi Gu, Meng Cao, Haoping Bai, Ping Huang, Jiulong Shan and Jianjun Shi

Georgia Institute of Technology and the Apple Company

"Graph Laplacian Based Spatial-Temporal Process Monitoring of Unstructured High-dimensional Streaming Data Using Autoencoders"

Qian Wang and Kamran Paynabar

Georgia Institute of Technology

- Finalists of 2023 ProcessMiner QCRE Data Challenge Competition

Co-chairs: Dr. Xiaolei Fang (NCSU), Praneeth Reddy (ProcessMiner), Shancong Mou (Georgia Tech)

"Sequence-to-Sequence LSTM for Fungal Spores Concentration (FSC) Prediction"

Bo Shen, Raghav Gnanasambandam, Jihoon Chung

New Jersey Institute of Technology, Virginia Tech

"A Knowledge Guided ML framework for Predicting Fungal Spores Concentration"

Md Asif Bin Syed, Imtiaz Ahmed, Azmine Toushik Wasi

West Virginia University, Shahjalal University of Science and Technology

"MTVAE-CGMM: A deep Bayesian approach for imbalanced data classification and prediction with applications in fungal spore concentration prediction"

Yichao Zeng , Wael Hassanieh, Mayuresh Savargaonkar, Abdallah Chehade

University of Michigan – Dearborn

"Fungal Spores Concentration Prediction With a Hybrid Multilayer Neural Network"

Afshin Asadi, Ramin Moghaddass

University of Miami

- Finalists of the 2023 QCRE Best Student Paper Award

Co-chairs: Dr. Dan Li (Clemson University), Dr. Xiaowei Yue (Virginia Tech)

"A Rollout Approach for Condition-Based Maintenance of Large Multi-Unit Systems"

Vipul Bansal

University of Wisconsin, Madison

Co-authors: **Yong Chen, and Shiyu Zhou**

"DETONATE: Nonlinear Dynamic Evolution Modeling of Time-dependent 3-dimensional Point Cloud Profiles"

Michael Biehler

Georgia Institute of Technology

Co-author: **Jianjun Shi**

"Federated Generalized Scalar-on-Tensor Regression"

Elif Konyar

University of Florida

Co-author: **Mostafa Reisi Gahrooei**

"Online Monitoring of Heterogeneous Partially Observable Data Streams based on Q-learning"

Haoqian Li

University of Wisconsin, Madison

Co-authors: **Honghan Ye, Jing-Ru C. Cheng, Kaibo Liu**

2023 QCRE Teaching Award

Chair: Dr. Aziz Ezzat (Rutgers University)

The QCRE Teaching award recognizes excellence in the instruction of an undergraduate course in quality control and engineering, statistics/analytics, and reliability methods or applications.

Winner: Dr. Yu Liu,

Department of Industrial Engineering, University of Electronic Science and Technology of China

for his innovation, passion, and excellence in teaching the theory and applications of reliability engineering

QCRE Webinar Highlights 2022-2023

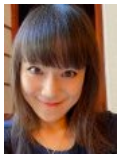
Chairs: Dr. Xiaolei Fang (NC State) and Dr. Na Zou (Texas A&M)

We would like to extend our sincere gratitude to our esteemed webinar speakers for sharing their valuable insights and expertise with us. This year, QCRE has had a total of 7 webinars, listed below:

- **Speaker:** Kaibo Liu, Associate Professor, Department of Industrial and Systems Engineering, UW-Madison
  - **Title:** Online Monitoring of Big Data Streams -- Roadmap and Recent Advances
  - **Date:** 11/17/2022
  - **Organizing Divisions:** QCRE and DAIS
  - **Link:** https://www.iise.org/media/Data_Analytics/DAIS-QCRE-Webinar-111722.mp4

- **Speaker:** Dr. Adel Alaeddini, Associate Professor of Mechanical Engineering, University of Texas at San Antonio (UTSA)
  - **Title:** Dynamic Characterization and Optimal Self-Management of the Emergence Trajectories of Multiple Chronic Conditions
  - **Date:** 12/06/2022
  - **Organizing Divisions:** QCRE and DAIS
  - **Link:** https://www.iise.org/media/QCRE/QCRE-Webinar-12.6.22.mp4

- **Speaker:** Dr. Chenhui Shao, Associate Professor, Department of Mechanical Science and Engineering, UIUC
  - **Title:** Doing More with Less: Cost-Effective Machine Learning for Manufacturing Quality Control
  - **Date:** 02/21/2023
  - **Organizing Divisions:** MD and QCRE
  - **Link:** https://www.iise.org/media/Manufacturing/2023/MD-QCRE-022123.mp4



- **Speaker:** Dr. Cao (Danica) Xiao, the VP of AI/ML Research @Relativity
  - **Title:** Machine Learning for Digital Transformation of Clinical Trials and Legal Review
  - **Date:** 02/27/2023
  - **Organizing Divisions:** DAIS and QCRE
  - **Link:** TBD

- **Speaker:** Dr. Hoang Pham, Distinguished Professor, Department of Industrial and Systems Engineering, Rutgers University
  - **Title:** Do Reliability and Machine Learning Models With Time Delays and Model Selection Matter?
  - **Date:** 03/02/2023
  - **Organizing Divisions:** DAIS and QCRE
  - **Link:** TBD

- **Speaker:** Dr. Shawn Sheng, senior research engineer at NREL (Joint Webinar with the Energy Systems Division)
  - **Title:** Wind Turbine Drivetrain Reliability Research – Illustrated using Gearbox Bearing Axial Cracking Failure Mode as an Example
  - **Date:** 04/13/2023
  - **Organizing Divisions:** ESD and QCRE
  - **Link:** TBD

QCRE Member Spotlight

In each issue of QCRE newsletter, we will feature one outstanding QCRE member who has demonstrated the excellence in the QCRE related fields, and the member can be from academia, industry or our students.

An Interview with QCRE Scholar:
Prof. Yu Ding

In this issue of QCRE newsletter, we feature our outstanding member, Dr. Yu Ding. Dr. Yu Ding is the Mike and Sugar Barnes Professor of Industrial & Systems Engineering at Texas A&M University and Associate Director for Research Engagement of Texas A&M Institute of Data Science. Dr. Ding received his Ph.D. degree from the University of Michigan in 2001. His research interest is in data and quality science, with impact targeting two broad sets of applications: wind energy and manufacturing. Dr. Ding authored the CRC Press book, *Data Science in Wind Energy*, in 2019 and co-authored the Springer book, *Data Science for Nano Image Analysis*, in 2021. Dr. Ding is the recipient of the 2019 IISE Technical Innovation Award and 2022 INFORMS Impact Prize. Dr. Ding is a Fellow of IISE and ASME and is serving as the Editor-in-Chief of *IISE Transactions* for the term of 2021-2024.

Here is Dr. Yu Ding's Story with QCRE.

- ***What are your experiences with QCRE division at IISE?***
  I have a wonderful experience with QCRE division. Ever since when I was a junior faculty member, I regularly came to IISE annual conference and attended QCRE business meetings (later renamed to Townhall meeting, I suppose). I met old friends and made new friends through this important professional network.

- ***How have these experiences helped you in your career?***
  Finding one's professional home is a very important first step in one's career development. QCRE division provides such a home within IISE for those of us who are working on quality and reliability research. Through this professional association, one stays on top of the knowledge development, is fully appraised of the state-of-the-art research activities and trends, and learns from our esteemed colleagues. This home also provides a platform for us to showcase our graduate students and train them for their future career. One cannot grow mature without such a warm and welcoming home. When I grow older, I really cherish all the fond memories of being a member of this wonderful professional home.

- ***How do you stay current with developments in your field, and what resources do you rely on?***
  Becoming a member of QCRE and being active like the current and past QCRE officers. The resources for doing so are very moderate---just one's willingness to spend some time helping others and a little travel fund to attend the annual conferences.

- ***What are some upcoming projects or initiatives you are working on that you are excited about ?***
  Retirement, perhaps ☺. I have been working on data and quality science in the past 20+ years with two applications in focus: wind energy and manufacturing/materials. I suppose that I will just stay on course.

- ***Any suggestions to future fellow students?***
  One of my favorite quotes was from George Box, who said "*All models are wrong, but some are useful*." As engineering scholars, we need to be mindful of the usefulness of our research developments. Great engineers develop simple, implementable, and interpretable methods that are adopted by practitioners and enable tangible and appreciable changes in engineering practice.

Research Story

In each issue of QCRE newsletter, we feature a research story. This could be a novel research work pursued by a group of QCRE researchers, or a topic of relevance to the QCRE community.

"In-Process Quality Improvement: Concepts, Methodologies, and Applications"

By *Prof. Jianjun Shi*

In this issue of the newsletter, we feature Dr. Jianjun Shi, Carolyn J. Stewart Chair and Professor at the Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology. Dr. Shi is a leading scholar in the field of industrial and systems engineering, with a focus on the fusion of advanced statistical and domain knowledge to develop methodologies for modeling, monitoring, diagnosis, and control for complex manufacturing systems. His research achievements have been recognized with major awards, specifically the George Box Medal (2022), the ASQ Walter Shewhart Medal (2021), the S. M. Wu Research Implementation Award (2021), the ASQ Brumbaugh Award (2019), the Horace Pops Medal (2018), the IISE David F. Baker Distinguished Research Award (2016), and the IIE Albert G. Holzman Distinguished Educator Award (2011). He is the founding chairperson of the Quality, Statistics and Reliability (QSR) Section at INFORMS (1998-1999).

He was also former Editor-in-Chief of IISE Transactions (2017-2020). Dr. Shi is a Fellow of four professional societies, including ASME, IISE, INFORMS, and SME, an elected member of the International Statistics Institute (ISI), an Academician of the International Academy for Quality (IAQ), and a member of National Academy of Engineering (NAE).

In his recent position paper titled "*In-process quality improvement: Concepts, methodologies, and applications*", published in IISE Transactions, Dr. Shi summarized his vision on the implementation of In-Process Quality Improvement (IPQI) in manufacturing systems. The paper can be found at DOI: 10.1080/24725854.2022.2059725. We have attached the abstract of the paper for reference. Also, an interview with Dr. Shi on his journey of developing the methodology of in-process quality improvement and its relevance in the new era of advanced manufacturing and data science revolution can be found at https://www.youtube.com/watch?v=HP7oQyVmvG0.

- ***Abstract***

  This paper presents the concepts, methodologies, and applications of In-Process Quality Improvement (IPQI) in complex manufacturing systems. As opposed to traditional quality control concepts that emphasize process change detection, acceptance sampling, and offline designed experiments, IPQI focuses on integrating data science and system theory, taking full advantage of in-process sensing data to achieve process monitoring, diagnosis, and control. The implementation of IPQI leads to root cause diagnosis (in addition to change detection), automatic compensation (in addition to off-line adjustment), and defect prevention (in addition to defect inspection). The methodologies of IPQI have been developed and implemented in various manufacturing processes. This paper provides a brief historical review of the IPQI, summarizes the developments and applications of IPQI methodologies, and discusses some challenges and opportunities in the current data-rich manufacturing systems. The prospect for future work, especially on leveraging emerging machine learning tools for addressing quality improvements in data-rich advanced manufacturing processes, is discussed at the end of the paper.

Link to the paper: https://www.tandfonline.com/doi/full/10.1080/24725854.2022.2059725

Division's Quarterly News

- Michael Biehler, Ph.D. Candidate, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Tech, has been awarded the Mary G. and Joseph Natrella Scholarship from the American Statistical Association (ASA). He has also been awarded a fellowship in Interdisciplinary and Health and Environment Leadership Development supported by Burroughs Wellcome Fund, and is a fellow of the George Fellows Leadership Program in Health Systems and Analytics. He has also received the Phillip J. and Delores A. Scott Graduate Student Health and Wellness Award at Georgia Tech ISyE for organizing activities and strongly advocating for student physical and mental health.
- Nathan Gaw, Assistant Professor of Data Science, Air Force Institute of Technology has received a $136,269 grant from Air Force Research Lab (AFRL)/Air Force Office of Scientific Research (AFOSR) Intramural Program (LRIR) for "Fusion of Scanning Acoustic Microscopy and Eddy Current Images for Materials Analysis" from 1 July 2022 - 30 September 2025.
- Xiaowei Yue, Assistant Professor and Grado Early Career Faculty Fellow, Virginia Tech, has been selected to be the recipient of Dr. Hamed K. Eldin Outstanding Early Career IE in Academia Award in 2023.
- Na Zou, Assistant Professor, Engineering Technology & Industrial Distribution, Texas A&M University, has received an NSF CAREER award for her proposal titled, "Exploring and Exploiting Data-Centric Modeling for Fairness in Machine Learning". This project is to investigate data-centric algorithms and theories to facilitate fairness through improving data quality, expanding prior knowledge, and utilizing enhanced data and prior knowledge in implicit fairness modeling.

Call for Entries

The division is publishing its quarterly newsletters and hereby soliciting news entries. This is a great opportunity to showcase interesting yet impactful researches, professional practices and educational efforts within the division. The solicited story will go into the following blocks in the newsletter: Research on the News, Practical Applications, and Education and Outreach. It would be great if you could: Please fill in the following Google form: https://forms.gle/zHhGSrgeCvgJgDnF9 or send an email to Dr. Aziz Ezzat (aziz.ezzat@rutgers.edu). Your entry will appear in the next available division newsletter.

PDF version of our newsletters are available for our members on the IISE Connect (QCRE division Library folder), as well as our Facebook Page, LinkedIn Profile, and Twitter.

Please Reach Us At:

IISE QCRE Official LinkedIn Account

IISE QCRE Official Facebook Account

@QCREIISE Official Twitter Account