Safety Engineering and Risk/Reliability Analysis Division Newsletter

Vol. 2-June 2019 Edition

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CHAIR'S NOTE

Dear SERAD Members,

The last quarter of FY2019 is over. Looking back, SERAD has accomplished a lot this year. We had a successful IMECE2018 and continued our tradition of annual student contest and awards ceremony at IMECE. For the first time, the student winners had opportunities to practice their presentation skills at a professional technical conference. For IMECE2019, we have received record-breaking 43 papers in 11 topics submitted to our technical paper track. This year, we also saw the SERAD newsletters being released to our members every quarter with high quality contents. In April, SERAD initiated and co-hosted a first-ever ASME forum/workshop on "Risk Analysis for Autonomous Vehicles, Issues and Future Directions" with University of Maryland. This event was very successful and received attention and congratulatory notes from Dr. Said Jahanmir, the president of ASME. In addition, through an established long-term partnership with the ASCE-ASME JOURNAL OF RISK AND UNCERTAINTY IN ENGINEERING SYSTEMS (JRUES), we are sponsoring the Best Paper Award for Part B: Mechanical Engineering of the Journal at the coming IMECE conference.

It is also the time for our annual update of leadership team. It is my pleasure to announce that starting July 2019, Dr. Jeremy Gernard will assume the divisional chair position, Dr. Mohammad Pourgol-Mohammad will serve as the 1st vice chair, Dr. Xiaobin Le will serve as the 2nd vice chair and treasurer, Dr. Arun Veeramany will assume the position of 3rd vice chair of membership, and Dr. Stephen Ekwaro-Osire, professor of Mechanical Engineering at Texas Tech University, will become the new member of SERAD executive committee and serve as the secretary. SERAD is honored to have Stephen join the EC leadership team and will be looking forward to his great contribution and leadership in the coming years. In addition, for FY20, SERAD extended leadership team will have our veteran contributors Dr. Dengji Zhou serving as our chair for student relations and contest, Dr. Mihai Diaconeasa to serve as the IMECE2020 SERAD track chair, and Dr. Alba Sofi continuing to serve as the chair for journal (JRUES) liaison.

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INTERPLAY OF RISK, RELIABILITY AND RESILIENCE IN ENERGY SYSTEMS

Arun Veeramany, PhD
Pacific Northwest National Laboratory

A system is said to be resilient when it can manage the risk associated with unforeseen as well as anticipated abnormal events (resilience events) aiming for minimal disruption to services, least harm to life and environment, and least possible asset damage for owners. This definition of a resilient system is an attempt to be a catchall for various definitions that spell out the actual mechanism of achieving resilience embedded within the definition itself. The National Infrastructure Advisory Council (NIAC) framed resilience with four dimensions – robustness, resourcefulness, rapid recovery, and adaptability. These dimensions also closely align with corresponding attributes of mitigation, response, recovery and preparation. Robustness or mitigation refers to the ability to have controls in place well in advance that absorb disturbances while ensuring continued operation during resilience events. Resourcefulness or responsiveness is the ability to immediately spring into action at the onset of a resilience event. These actions include automatic or operator-induced invocation of protection systems, and dispatch of trained crew to quickly assess and respond to the situation. Recovery follows emergency response and refers to suite of actions to spring back into providing reliable services. Preparation or adaptability allows for preparing for future events by learning from past events. This phase completes a loop and hence can either be before the event or after the resilience event.

A consensus is that a resilient system can reduce the magnitude of consequences and/or duration of an undesirable event. The consequences can be equipment damage and/or widespread outages resulting in cascading effects including loss of human life. The steps taken towards reducing the intensity can either be before, during, or after the event. These correspond to preventive actions, emergency response actions, and corrective actions and actionable lessons learned. It is challenging to apportion resources among these actions spanning different resilience phases due to presence of broad uncertainties. Too many preventive actions for anticipated events with very low likelihood are expensive. So are the actions associated with corrective actions. The latter may at times be too late involving harm to life and society. Nevertheless, resources must be allocated to all phases of resilience.

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ASCE-ASME JOURNAL OF RISK AND UNCERTAINTY IN ENGINEERING SYSTEMS, PART A: CIVIL ENGINEERING, PART B: MECHANICAL ENGINEERING

Alba Sofi, PhD
University "Mediterranea" of Reggio Calabria, Italy

Established in 2014 by the current Editor-in-Chief, Professor Bilal M. Ayyub from the University of Maryland College Park, the ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering and Part B: Mechanical Engineering, serves as a medium for dissemination of research findings, best practices and concerns, and for discussion and debate on risk and uncertainty-related issues in the areas of civil and mechanical engineering and other related fields. The journal addresses risk and uncertainty issues in planning, design, analysis, construction/ manufacturing, operation, utilization, and life-cycle management of existing and new engineering systems.
The journal has been accepted into the Emerging Citation Sources Indexed by Clarivate Analytics, formerly Thomson Reuters, and it is eligible for indexing in 2018. From 2016 onward, all articles will be included in Web of Science. They are also included in Scopus.

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IMECE

International Mechanical Engineering Congress and Exposition

November 08 2019 - November 14 2019, Friday - Thursday

Venue & Location:
Salt Lake City Convention Center
100 S. West Temple
Salt Lake City, Utah , USA

Important Dates:
February 25 2019
Submission of Abstract for Full Papers
March 18 2019
Author Notification of Abstract Acceptance
April 29 2019
Submission of Full-Length Paper

Call for Papers: Track 13 – Safety Engineering, Risk and Reliability Analysis

"Safety Engineering, Risk and Reliability Analysis" is a track for ASME 2019 International Mechanical Engineering Congress and Exposition. We are now to seek for topic organizers to fill following topics. If you are interested in this opportunity, please contact us by email. The Track contains a collection of Topics in the broad area of safety engineering and risk analysis, which are individually organized by leading researchers in the field. The Topics give a comprehensive coverage of experimental, computational, and analytical approaches.

Dengji Zhou Ph.D, Shanghai Jiao Tong University, <zhoudj@sjtu.edu.cn>
Mihai Diaconeasa Ph.D, B. John Garrick Institute for the Risk Sciences, UCLA, <mihai@risksciences.ucla.edu>
Mohammad Pourgol-Mohammad Ph.D, Johnson Controls Inc./Sahand University of Technology, York, PA, United States, <pourgol-mohamadm2@asme.org>
John Wiechel Ph.D, SEA, Limited, < jwiechel@sealimited.com >

Topic:
1. Reliability Methods.
2. Failure and forensic analysis.
3. Testing for product reliability and safety.
4. Reliability and risk in energy systems.
5. Reliability and risk in manufacture systems.
6. Prognostic and health management.
7. Safety, risk and reliability of emerging technologies.
8. General topics on risk, safety and reliability.
9. Safety in transportation, agriculture, and off-road vehicles.
10. Crashworthiness, occupant protection, and biomechanics.
11. Student contest presentation

Researchers and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Reliability, Safety, and Risk. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Reliability, Safety, and Risk will serve as the foundation upon which the conference program of this area will be developed.

UMD/ASME SERAD WORKSHOP ON RISK ANALYSIS FOR AUTONOMOUS VEHICLES: ISSUES AND FUTURE DIRECTIONS

April 26, 2019
Kay 1-2 Boardrooms
A.J. Clark School of Engineering
University of Maryland
College Park, MD USA

SUMMARY

We have witnessed remarkable technology advancements and competitions in autonomous and connected transportation vehicles. These include major developments of self-driving electric cars by new technology development companies such as Waymo and Tesla, and by the traditional automobile manufacturers that include the Ford Motor Company, Mercedes-Benz and Rolls-Royce. In this rapidly changing world, cities are growing fast. With urban centers dealing with record levels of traffic and pollution, the United Nations has identified increasing urbanization as one of the defining trends of the 21st century. This growth is also causing a shift from individual vehicle ownership to the use of shared mobility options such as ride-hailing services. Most of our infrastructure was built to meet the needs of individually used vehicles. However, most of those vehicles sit idle about 95% of the time. Because of this, as much as 30% of the real estate in city centers is devoted to parking. The Ford Motor Company, for example, sees this as an opportunity to design smart vehicles for a smart world. If applied correctly, new technologies can enable solutions to help city transportation systems improve the quality of life for everyone. That's why Ford is approaching these opportunities in a holistic way. The company recognizes that just injecting new mobility technologies and services into a city or neighborhood won't solve their existing challenges and may even make them worse. While technology development has been the prime focus of the most recent technology innovations, the industry's advances on the issues of safety, risk and reliability has been slow. A number of accidents and near-misses have already occurred, the mean distance driven to an unsafe condition, near miss or accident has been far shorter than the conventional road vehicles. While the public at large is extremely excited about these technologies, concerns over safety, software reliability, security, hacking/misuse, and licensing are mounting.

Given some vacuum in formal safety, risk, and reliability considerations in this of rapidly evolving transportation technology, convergence of many related resources involving academia, autonomous vehicle industry, insurance and related government agencies would be desirable to identify and address the related technology, policy and regulatory developments needed. Far more attention by the industry and research by the government would be needed to close these safety gaps. Some of the major issues identified by the workshop as examples of the safety improvement needs include: *- CONTINUED ON PAGE 9*

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Chair's Note

Furthermore, Mr. Ernie Kee has agreed to join SERAD as the communications & outreach chair, whose primary responsibility is compiling/editing the divisional newsletter. Ernie brings over 40 years of experience in reliability and risk analyses. SERAD is fortunate to have such a seasoned engineer and scholar volunteering and contributing to our division.

While stepped down from SERAD chair position as of 7/1, I will continue my support to the division. With our great volunteers, I sincerely believe SERAD will continue its traditions, success and achieve new heights in many years to come.

So long!

Bin Zhou, Ph.D.

ASME SERAD Chair 2018-2019

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Interplay of Risk, Reliability and Resilience in Energy Systems

Reliability and resilience are measures of risk as both carry inherent uncertainties and have bearing on the objective of providing highly reliable electricity with minimized interruption duration and frequency. Reliability events are operational in nature and their frequency and magnitude can be predicted with some degree of confidence. Examples include failure rate of components and other causes of common outages which can often be resolved using repair, replacement and efficient restoration techniques within tolerable time duration. Reliability events are captured through utility outage management systems. Major events are often excluded in the estimation of reliability metrics. Resilience events are not only interruptions, but also are the ones that challenge the ability to respond and recover to normal reliable conditions within socially acceptable time frames. A resilient system must be able to continue to provide services albeit under non-reliable conditions until operational conditions are restored. Metrics associated with reliability and resilience are critical for valuation of energy systems despite similarities and differences between them.

Resilience is better understood in the context of risk when supported by a risk metric. Risk to the power grid owing to a resilience event can be expressed as a triad <s, ps, cs> where s is an abnormal scenario during a resilience event, ps is the probability of the scenario happening, and cs is the consequence of occurrence of the scenario. The consequence is quantified as the product of magnitude (ms) and duration (ds) of the event. When put in perspective, risk is the product psmsds for the scenario s. A potential risk metric, then, is measured in terms of energy unserved in MWh and when further extended, it can become an economic risk metric.

An example scenario is 120% increase in demand in excess of available margins on a peak heat day. The probability of this scenario happening can be obtained from a combination of weather records, forecast algorithms, and engineering judgment.
Valuation experts often want to compare existing resilience features (baseline) against proposed resilience mechanisms. The value of new resilience measures is in the ability to reduce risk over the baseline. The implementation and quantification of such mechanisms in the form of services can have profound impacts on power system resilience when measured using a risk metric. While probability of occurrence of causal scenario (e.g., peak heat day) does not change due to new mechanisms, the magnitude and duration of the event can be influenced. For example, if successful deployment of a demand-response program can reduce duration of an abnormal event by half, then the resulting risk psms(ds/2) is halved, denoting an increase in resilience.

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ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering, Part B: Mechanical Engineering

RECOGNITIONS AND AWARDS
Part A: Editor's Choice Paper
"Reliability Analysis Using Adaptive Kriging Surrogates with Multimodel Inference", by V.S. Sundar and Michael D. Shields.

Part B: Most Accessed Article in 2018
"How to Take Into Account Model Inaccuracy When Estimating the Uncertainty of the Result of Data Processing" by Vladik Kreinovich, Olga Kosheleva, Andrzej Pownuk and Rodrigo Romero.

Part A: 2018 Outstanding Reviewers
Nii O. Attoh-Okine, Miltiadis Alamaniotis, André T. Beck, Eleni Chatzi, Nicholas Chileshe, Ghada M. Gad, Zhen Hu, Sabarethinam Kameshwar, Ahmed Lasisi, Athanasios A. Pantelous, Nicola Pedroni, Xiaohui Qi

Part B: Reviewers of the Year 2018
Sifeng Bi, Zhifu Zhu

Best Paper Award

Starting in 2019, the Best Paper Award will be given annually to one paper in Part A and one paper in Part B appearing in the preceding volume year. Papers published in 2018 have been evaluated by the Editorial Board members based on the following criteria: fundamental significance, potential impact, practical relevance to industry, intellectual depth and presentation quality.

The recipients of the Award for the Best Paper published in 2018 in Part A and Part B will be announced at the ASME Safety Engineering and Risk Analysis Division (SERAD) award reception meeting at the International Mechanical Engineering Congress & Exposition (IMECE) during the period November 11- 13, 2019 in Salt Lake City, Utah, https://event.asme.org/IMECE. Each author will receive a plaque with travel support offered by ASME to one author to receive her/his plaque at IMECE 2019.

2018 Part A Recipients:

Authors: Arvid Naess, F.ASCE, and Harald Svandal Bo

Title: "Reliability of Technical Systems Estimated by Enhanced Monte Carlo Simulation"

URL: https://ascelibrary.org/doi/10.1061/AJRUA6.0000937

Overall assessment:

This paper deals with computing reliability of large technical systems. There are many techniques to approximate exact reliability with very complicated procedure. In this paper, a new method based on Monte Carlo simulation for efficient calculation of system reliability is presented. Standard Monte Carlo simulation forms a simple and robust alternative for calculating system reliability, while the computation is very time consuming. The authors introduces a parameterized system that corresponds to the given system for a specific parameter value. By using regularity of the system reliability as a function of the introduced parameter, the system reliability for our original system can be predicted accurately from relatively small samples.

2018 Part B Recipients:

Authors: S. Wu, P. Angelikopoulos, C. Papadimitriou, P. Koumoutsakos

Title: "Bayesian Annealed Sequential Importance Sampling: An Unbiased Version of Transitional Markov Chain Monte Carlo"

URL: http://risk.asmedigitalcollection.asme.org/article.aspx?articleid=2647605

Overall assessment:

The paper demonstrates a bias emanating from the resampling steps in the transitional Markov chain Monte Carlo (TMCMC) algorithm which has not been recognized and explicitly studied in the literature. The so-called Bayesian Annealed Sequential Importance Sampling (BASIS) approach is proposed to remove this bias and at the same time increase the parallel efficiency of the traditional TMCMC. The proposed method is clearly presented and substantiated by numerical results concerning problems of engineering interest. The BASIS

approach has a potentially high impact, since it improves the applicability of the traditional TMCMC which is an attractive tool for uncertainty quantification in engineering problems.

CALL FOR PAPERS
Part A: active Calls for Special Collections
Special Collection on "Risk Analysis Principles for Structural Heath Monitoring". Paper submission deadline: July 31, 2019.

Part B: active Calls for Special Issues
Special Issue on "Resilience of Engineering Systems" . Paper submission deadline: July 31, 2019.
Special Issue on "Uncertainty Management in Complex Multiphysics Structural Dynamics". Paper submission deadline: September 30, 2019.

SUBMISSION
Part A: https://ascelibrary.org/journal/ajrua6
Part B: http://risk.asmedigitalcollection.asme.org/journal.aspx

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UMD/ASME SERAD Workshop on Risk Analysis for Autonomous Vehicles: Issues and Future Directions

•Need to develop more case studies.
•Building of more incentives on the part of the industry to promote, further satisfy and engage with NHTSA
•Development of clear top-down safety requirements.
•Reliance on more modern safety and risk-based analysis methods and simulations.
•Avoidance of using the old safety analysis methods practiced in the conventional level-0 and level-1 vehicle technologies, and develop new out-of-the-box safety methods.
•Investigate and optimize the use of more redundancies in the safety equipment of driverless vehicles.
•Develop approaches for better safety enforcement
•Understand, study and model the role of human behavior and intensions in fully autonomous vehicles.

PROGRAM

8:30-8:45 Welcome Messages and Objectives
Prof. Mohammad Modarres, Nicole Y. Kim Eminent Professor of Engineering, University of Maryland (UMD)
Prof. Darryll J. Pines, Nariman Farvardin Professor and Dean A.J. Clark School of Engineering, University of Maryland

8:45-9:15 Sponsors Messages: ASME and Ford Motor Company Interests in Autonomous Vehicles (Dr. M. Pourgolmohamad, ASME SERAD Chair-Elect, Sr. Manager at Johnson Controls Inc., Moderator)
Dr. Said Jahanmir, President of ASME
Dr. Vasiliy Krivtsov. Director of Reliability Analytics, the Ford Motor Company

9:15 – 10:15 (Part I) Advances in Safety and Coordination Frameworks of Connected Autonomous Vehicles (Dr. Mark Fuge, Assistant Professor UMD, Moderator)

Prof. Phil Koopman, Associate Professor of Electrical and Computer Engineering, Carnegie Mellon University
Assuring Autonomous Vehicle Safety

Autonomous vehicles bring with them the promise of dramatically reduced road mishaps. However, making self-driving cars as safe as a person is more difficult than is widely acknowledged. Unimpaired human drivers, while imperfect, are actually quite impressive. While computers don't drive drunk, they do have failure modes that differ dramatically from humans, especially in the area of perception. Ensuring safe deployment of this technology will require significant augmentation to existing safety standards. In particular, we will need to find a responsible way manage uncertainty as a first class citizen, and to determine an acceptable level of risk tolerance while we wait the years it will take for the technology to mature.

Prof. Andreas A. Malikopoulos, Terri Connor Kelly and John Kelly Career Development Associate Professor, University of Delaware
A Decentralized Energy-Optimal Control Framework for Connected and Automated Vehicles

We are currently witnessing an increasing integration of energy and transportation, which, coupled with human interactions, is giving rise to a new level of complexity in the next generation of transportation systems. Connected and automated vehicles (CAVs) provide the most intriguing and promising opportunity for enabling users to better monitor

transportation network conditions and make better operating decisions to reduce energy consumption, greenhouse gas emissions, travel delays and improve safety. While several studies have shown the benefits of CAVs to alleviate traffic congestion and reduce fuel consumption in specific transportation scenarios, one key question that remains unanswered is "how much can we improve fuel consumption, if we assume that the vehicles are connected and can exchange information with each other and with infrastructure?" In this talk, I will present a decentralized optimal control framework whose closed-form solution exists under certain conditions, and which yields for each vehicle the optimal acceleration/deceleration at any time in the sense of minimizing fuel consumption. The solution allows the vehicles to cross the intersections and merging roadways without the use of traffic lights, without creating congestion, and under the hard safety constraint of collision avoidance.

10:30 – 12:15 (Part II) Policy, Technology and Regulatory Initiatives (Dr. Lei Zhang, Ph.D. Herbert Rabin Distinguished Professor, Director, Maryland Transportation Institute, Moderator)

Mr. Gregory Slater, Administrator, Maryland Department of Transportation
Maryland Cybersecurity Initiatives in a Connected and Autonomous World.

The rise of new technologies has and will continue to increase mobility choices that test the State's transportation resiliency. Maryland Department of Transportation State Highway Administration's (MDOT SHA) Administrator Mr. Gregory Slater will provide a brief overview of MDOT SHA's initiatives in the digital infrastructure world, how we plan to support public needs and shape a safe and efficient transportation network.

Ms. Dee Williams, Deputy Associate Administrator for Vehicle Safety Research, National Highway Traffic Safety Administration (NHTSA), U.S. Department of Transportation
NHTSA's FMVSS Considerations for Vehicles with Automated Driving Systems

The presentation will cover NHTSA's policy, research, and regulatory efforts under consideration at the Agency for vehicles equipped with Automated Driving Systems (SAE L3-L5).

Ms. Marjory S. Blumenthal, Director, Science, Technology, and Policy Program
RAND Corporation, Washington, DC Office
Measuring Automated Vehicle Safety: Building Better Outcomes and Policy

Public trust—and the public interest—in automated vehicles demands understanding of how safe they are, especially once they operate on public roads. Today, the race to develop working and, ultimately, commercially deployed AVs is characterized by idiosyncratic approaches. Not only do developers make different choices for their essential technologies, they approach testing in different ways and they report testing results both selectively and in developer-specific ways, even when seeming to use the same measure. Recently completed research shows how it is possible to have a framework for measuring AV safety that is technology- and company-neutral. Using such a framework would foster both comparability across companies and vehicles and broader understanding of the safety performance of AVs as they progress through development to deployment. Such a framework could be complemented by additional steps to foster transparency and comparability. Public policy provides the backdrop and shapes the incentives for progress that also involves collective action by industry.

Prof. Mohammad Modarres, Director Center for Risk and Reliability (CRR)
What we can learn from risk-informed approach to regulating nuclear power plants?

This presentation offers an overview of the way risk of accidents has been addressed in design and operation of nuclear power plants by the nuclear industry in the U.S. It draws a parallel between the early stages of the nuclear energy development and the current trends in the autonomous vehicle development. The presentation points to nuclear industry's efforts to restore and manage safety over its 60 years history. On the basis, conclusions will be drawn about the relevance of the formal probabilistic risk assessment and risk-informed decision making to autonomous vehicles design and policy development.

12:15-1:45 LUNCH Speaker: Dr. Roger McCarthy, P.E., McCarthy Engineering
(Welcome and introduction by Dr. Bala Balachandran, Minta Martin Professor of Engineering and Chair, Department of Mechanical Engineering)

No vehicle technology has caused more excitement, investment than potential vehicle "autonomy" (SAE or NHSTA level 4 & 5). Since the "critical pre-crash event" of ~94% of US traffic accidents is a "driver critical reason(s)," vehicles driven by a fast-autonomous agent that does not blink, sleep, drink, etc. spawn "predictions" of unprecedented safety impact. Autonomous vehicle potential to revolutionize western economies is inestimable. The 8% utilization of current automobiles could increase 10X as autonomous cabs. The vast tracts of real estate now dedicated to road side parking, driveways, and garages could be reclaimed. Unfortunately, the "hype" surrounding all US self-driving vehicles, even though they are using somewhat different technologies, significantly overstates the current capabilities of

This talk presents the implementation of dynamic safety envelopes for Autonomous Remotely Operated Vehicles (AROVs). A safety envelope is defined as a three-dimensional spatial area around the AROV, which forms a virtual protective barrier against collision with known and unknown obstacles in the subsea environment. The Octree method is used to setup the cuboidal shape of the proposed safety envelope. A Fuzzy Inference System (FIS) is modeled to derive the size of the dynamic safety envelope. The three inputs of the proposed FIS are vehicle velocity, probability of acoustic sensor failure and time to collision risk indicator. A user interface allows for verification and visualization of the resulting dynamic safety envelope during live laboratory tests. The results show that similar to vehicular envelopes in other industries, dynamic safety envelopes can be implemented on AROVs. Dynamic safety envelopes may also be used to model the behavior of AROVs when confronted with different collision scenarios.

Dr. Mario Brito, Associate Professor in Risk Analysis and Risk Management, University of Southampton, UK
From autonomous underwater vehicles to unmanned marine surface vehicles: Reflections on risk models and expert judgment elicitations

Over the years, risk models have been developed to manage different types of hazards for marine autonomous systems. In this talk I will present a review of different models, discuss their effectiveness and limitations. The risk model can be informed by historical failure data, subjective expert judgments or by a combination of these two sources of assessments. When we attempted to combine historical data with expert subjective judgments, we realized that a new type of survival models was required. I will discuss this model and how this has been used to support actual decision making of marine autonomous systems operations in extreme environments. I will also discuss extensions to this model to capture other types of hazards.

3:15 – 4:15 (Part IV) Autonomous Vehicle Traffic Safety and Trajectory Planning Research (Dr. Jeffrey Herrmann, Professor of Mechanical Engineering and Institute for Systems Research, UMD, Moderator)

Prof. John Baras, Lockheed Martin Chair in Systems Engineering and Distinguished University Professor, Electrical and Computer Engineering, University of Maryland
Assured and Composable Safety in Connected Autonomous Vehicles

Prof. Gang-Len Chang, Director, Traffic Safety and Operations Lab., Department of Civil Engineering, University of Maryland.
Managing AV flows under different levels of highway congestion: A case study of MD100 congestion management

Recognizing the need for responsible highway agencies to effectively manage emerging AV flows in contending with daily recurrent congestion, this study has presented a systematic procedure for understanding the AV flows' impacts on the traffic conditions under different AV behavioral mechanisms (i.e., car-following and lane-changing), penetration rates. Our research results have indicated that the presence of AV flows, depending on their adopted behavioral mechanisms, may have significant (either positive or negative) impacts on the overall traffic conditions. Hence, it is essential for responsible highway agencies to have proper operational guidelines to manage and coordinate with AV flows. To demonstrate the proposed methodology, this study has further conducted simulation experiments using a congested segment of MD-100 network under various AV penetration rates and behavioral mechanisms. The collected MOEs highlight that at each AV penetration level there exists a set of optimal behavioral mechanisms for the AV flows to coordinate with non-AV flows via the V2I or V2V infrastructure so as to maximize the roadway capacity and minimize the resulting highway congestion.

4:30 – 5:30 OPEN DISCUSSION
5:30: ADJOURN

Call for Papers

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SETTING THE STANDARD

ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems: Part A. Civil Engineering and Part B. Mechanical Engineering
More information at http://www.asce-asme-riskjournal.org/
Contact Professor Bilal M. Ayyub, Editor in Chief, ba@umd.edu

2018-2019 SERAD LEADERSHIP POSITIONS

Executive Committee Positions 2018-2019

Chair:
Bin Zhou
bin.zhou@fmglobal.com
1st Vice-Chair:
Jeremy Gernand
jmg64@psu.edu
2nd Vice-Chair-Treasurer:
Mohammad Pourgol-Mohammad
pourgol-mohamadm2@asme.org
3rd Vice Chair-Membership:
Xiaobin Le
lex@wit.edu
4th Vice-Chair-Secretary:
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arun.veeramany@pnnl.gov
Past Chair:
Jennifer Cooper
cooperj2@asme.org

Appointed Positions

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Student Paper Award Chair:
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Dengji Zhou
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