SAFETY ENGINEERING & RISK ANALYSIS DIVISION

Division Newsletter
Volume 13, Second Quarter

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Featured ASCE-ASME Journal Papers; Three selected articles from the ASCE-ASME Journal in focus–Best Paper Award, Review, and Most read articles.

Editorial Page
Recent events in the news about firearms appear to call for engineered protections.

Chair's Message

Dear SERAD Members,

We hope you are all well. This is my last message as chair of our division. For our division, we have had a successful year and will have a successful year again in the coming year. The secret is that we have annually new leadership for the division. Dr. Arun Veeramany will be the next division chair for the 2022-2023 ASME fiscal Year. Dr. Veeramany is a senior scientist at Pacific Northwest National Laboratory. He specializes in the risk, reliability, and resilience of engineered systems in environmental, energy, and nuclear business areas. He will certainly bring his expertise, and research experiences to our division. We also have a new executive member Dr. Alba Sofi, who will serve as the 4th vice-chair and Secretary of our division. Actually, Dr. Alba Soft has actively participated in our division for several years as the liaison of the ASCE-ASME Journal of Risk and Uncertainty in Engineering system. Dr. Alba Sofi is an Associate professor of structural mechanics at University "Mediterranea" of Reggio Calabria. She will bring her successful story and rich academic & research experience to our division. The SERAD 22-23 executive committee members and their email addresses are listed here. You are welcome to contact us for any suggestions.

Chair	Dr. Arun Veeramany
1st Vice-Chair, ESS Liaison	Dr. Stephen Ekwaro-Osire
2nd Vice-Chair, Treasurer	Dr. Mihai A. Diaconeasa
3rd Vice-Chair, Membership	Dr. Andrey Morozov
4th Vice-Chair, Secretary	Dr. Alba Sofi

The SERAD division will continuously sponsor and organize the track 14: Safety Engineering, Risk and Reliability analysis in IMECE2022 (2022 IMECE® International Mechanical Engineering Congress & Exposition® (asme.org)), which will be held October 20–November 3, 2022 in Columbus, OH. This will be an in-person conference. Please reunite and engage with your friends and colleague during the conference. You will certainly find useful information. Wishing you all safety and health! Professor Xiaobin Le, Ph.D., PE ASME SERAD Chair, 2021-2022

Xiaobin Le, Ph.D., PE
ASME SERAD Chair, 2021-2022

The Future of Energy Storage

An Interdisciplinary MIT Study

This interdisciplinary MIT study examines the important role of energy storage in a potential future where decarbonized electricity systems would require massive storage capacity. Depending on the technology, approximately 30% of nameplate capacity can be realized from popular Variable Renewable Energy (VRE) sources such as wind and solar. The scale of the challenge to realize replacement of 70% of the total US energy consumption (about 97.3 quadrillion BTU in 2021) now based on carbon fuels is daunting. When scaled to world energy consumption, the problem is truly overwhelming and will require a massive research effort–developing the technology to store about 70% of that consumption makes clear the enormity of the challenge.

The MIT study is aimed at researchers who could use it as a comprehensive background on the "current state of affairs" of storage technologies and the settings where they are most useful. It is shown for example the production from wind and solar over a typical year in the time domain; cost trends and underlying technologies for different storage methods. Four chapters cover the known methods for storage, electrochemical, mechanical, thermal, and chemical. Four more chapters are devoted to modeling, market settings, governance, and innovation. The study is a comprehensive and detailed knowledge base and will be a great resource to the research community for the near- and far-term as they tackle the electrical storage problem required by VRE-based energy at scale.

Access the MIT report at: https://energy.mit.edu/wp-content/uploads/2022/05/The-Future-of-Energy-Storage.pdf

ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems
More Information: https://ascelibrary.org/journal/ajrub7 Contact Prof. Bilal M. Ayyub, Editor in Chief, ba@umd.edu

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, e-mail: alba.sofi@unirc.it

Established in 2014 by 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.

Starting with 2022, the editorship of the journal will be transferred from the Founding Editor-in-Chief, Professor Bilal M. Ayyub, to the Founding Associate Editor, The current Editor-in-Chief is the Founding Associate Editor, Professor Michael Beer, from Leibniz Universität Hannover.

Both Part A and Part B are listed in the Emerging Citation Sources by Clarivate Analytics, formerly Thomson Reuters, and are eligible for indexing in 2018. From 2016 onward, all articles will be included in Web of Science. They are also included in Scopus.

Part A has successfully secured an impact factor for 2021 of 3.084 based on the latest Journal Citation Reports by Clarivate Analytics.

Journal of Risk and Uncertainty contents

Issue	Latest Issues & (Issue Date)		
		Part B	Volume 9-Issue 1 (March 2023, in progress)
		Part B	Volume 8-Issue 4 (December 2022, In progress)
Part A	Volume 8-Issue 3 (September 2022, in progress)	Part B	Volume 8-Issue 3 (September 2022, In progress)
Part A	Volume 8-Issue 2 (June 2022, in progress)	Part B	Volume 8-Issue 2 (June 2022, In progress)
Part A	Volume 8-Issue 1 (March 2022)	Part B	Volume 8-Issue 1 (March 2022)
	2021 Table of Contents		
Part A	Volume 7-Issue 4 (December 2021)	Part B	Volume 7-Issue 4 (December 2021, in progress)
Part A	Volume 7-Issue 3 (September 2021)	Part B	Volume 7-Issue 3 (September 2021)
Part A	Volume 7-Issue 2 (June 2021)	Part B	Volume 7-Issue 2 (June 2021)
Part A	Volume 7-Issue 1 (March 2021)	Part B	Volume 7-Issue 1 (March 2021)

Latest State of the Art Reviews: Part A

"Resilience-Based Design of Infrastructure: Review of Models, Methodologies, and Computational Tools Resilience-Based Design of Infrastructure: Review of Models, Methodologies, and Computational Tools" by Mahdi Shadabfar,

Mojtaba Mahsuli, Yi Zhang, Yadong Xue, Bilal M. Ayyub, Hongwei Huang and Ricardo A. Medina

"Time-Dependent Reliability of Aging Structures: Overview of Assessment Methods" by Cao Wang, Michael Beer, and Bilal M. Ayyub

"Structural System Reliability: Overview of Theories and Applications to Optimization" by Junho Song, Won-Hee Kang, Young-Joo Lee, and Junho Chun

"Emerging Technologies for Resilient Infrastructure: Conspectus and Roadmap" by Mahmoud Reda Taha, Bilal M. Ayyub, Kenichi Soga, and Sherif Daghash

"Probabilistic Inference for Structural Health Monitoring: New Modes of Learning from Data" by Lawrence A. Bull, Paul Gardner, Timothy J. Rogers, and Elizabeth J. Cross

Latest Review Articles: Part B

"A Recent Review of Risk-Based Inspection Development to Support Service Excellence in the Oil and Gas Industry: An Artificial Intelligence Perspective", by Taufik Aditiyawarman, Agus Paul Setiawan Kaban, Johny Wahyuadi Soedarsono

"Prognostics and Health Management of Wind Energy Infrastructure Systems", by Celalettin Yüce, Ozhan Gecgel, Oğuz Doğan, Shweta Dabetwar, Yasar Yanik, Onur Can Kalay, Esin Karpat, Fatih Karpat, Stephen Ekwaro-Osire

"Uncertainty Quantification for Additive Manufacturing Process Improvement: Recent Advances", by Sankaran Mahadevan, Paromita Nath, Zhen Hu

"Optimizing Predictive Maintenance With Machine Learning for Reliability Improvement", by Yali Ren

"Path Integral Methods for the Probabilistic Analysis of Nonlinear Systems Under a White-Noise Process", by Mario Di Paola and Gioacchino Alotta

"Sensemaking in Critical Situations and in Relation to Resilience - A Review" by Stine S. Kilskar, Brit-Eli Danielsen, and Stig O. Johnsen

Latest Special Collections: Part A

"Special Collection on Bayesian Learning Methods for Geotechnical Data" Ka-Veng Yuen, Jianye Ching, and Kok Kwang Phoon

"Special Collection on Resilience Quantification and Modeling for Decision Making" Gian Paolo Cimellaro, and Nii O. Attoh-Okine

Latest Special Issues And Special Sections: Part B

"Special Section on Risk, Resilience, and Reliability for Autonomous Vehicle Technologies: Trend, Techniques, and Challenges"

"Special Section on Probabilistic Approaches for Robust Structural Health Monitoring of Wind Energy Infrastructure"

"Special Issue on Uncertainty Quantification and Management in Additive Manufacturing" Zhen Hu, Saideep Nannapaneni, and Sankaran Mahadevan

"Special Section on Risk and Uncertainties in Offshore Wind and Wave Energy Systems" Vikram Pakrashi, Jimmy Murphy, and Budhaditya Hazra

"Special Section: Nonprobabilistic and Hybrid Approaches for Uncertainty Quantification and Reliability Analysis" by Matthias G. R. Faes, David Moens, Michael Beer, Hao Zhang, and Kok-Kwang Phoon

"Special Section on Response Analysis and Optimization of Dynamic Energy Harvesting Systems in Presence of Uncertainties" Agathoklis Giaralis, Ioannis A. Kougioumtzoglou, and Pol D. Spanos

Recognitions & Awards

Recognitions for Papers

	Part A
Editor's Choice Paper	"Time-Series Prediction in Nodal Networks Using Recurrent Neural Networks and a Pairwise-Gated Recurrent Unit Approach", by Yanjie Tong and Iris Tien
Most Read Paper	"Climate Impact Risks and Climate Adaptation Engineering for Built Infrastructure" by Mark G. Stewart and Xiaoli Deng
Most Cited Paper	"Scale of Fluctuation for Spatially Varying Soils: Estimation Methods and Values"' by Brigid Cami, Sina Javankhoshdel, Kok-Kwang Phoon, and Jianye Ching
Editor's Choice Collection	For each issue of the journal, the Chief Editor may select a paper to be featured on the journal homepage in the ASCE Library. The paper is available for free to registered users for 1 to 4 months, depending on how frequently the journal is published. A list of Editor's Choice selections is available here.
	Part B
Most Read Paper	"Improving Site-Dependent Wind Turbine Performance Prediction Accuracy Using Machine Learning", by Sarah Barber, Florian Hammer, Adrian Tica
Most Cited Paper	"Structural Life Expectancy of Marine Vessels: Ultimate Strength, Corrosion, Fatigue, Fracture, and Systems" by Bilal M. Ayyub, Karl A. Stambaugh, Timothy A. McAllister, Gilberto F. de Souza, David Web
Featured Article	"Resilience Decision-Making for Complex Systems", by Julian Salomon, Matteo Broggi, Sebastian Kruse, Stefan Weber, Michael Beer

Outstanding Reviewers

Part A 2021 Outstanding Reviewers	Part B 2021 Reviewers of the Year
André T. Beck	Chen Jiang, *Huazhong University of Science and Technology, China*
Nicholas Chileshe	Imad Abdallah, *Eidgenössische Technische Hochschule Zürich, Switzerland*
You Dong	
Ketson Roberto Maximiano dos Santos	
Ao Du	
Cheng-Wei Fei	
Wenping Gong	
Cao Wang	
Jie Zhang	
Wengang Zhang	

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 are evaluated by the Editorial Board members based on the following criteria:

- fundamental significance
- potential impact
- practical relevance to industry
- intellectual depth
- presentation quality.

2021 Part A Recipients
Authors: Ali Khodam, Pooria Mesbahi, Mohsenali Shayanfar, Bilal M. Ayyub
Title: "Global Decoupling for Structural Reliability-Based Optimal Design Using Improved Differential Evolution and Chaos Control"

2021 Part B Recipient
Author: Panagiotis Alevras
Title: "On the Effect of the Electrical Load on Vibration Energy Harvesting Under Stochastic Resonance"

The award for the Best Paper published in 2021 in Part A and Part B will be presented to the authors in attendance at the ASME Safety Engineering and Risk Analysis Division (SERAD) award ceremony at the International Mechanical Engineering Congress & Exposition (IMECE) which will be held during the period October 30-November 3, 2022, Columbus, OH, https://event.asme.org/IMECE. The authors who will not be able to attend the ceremony in person will receive the award's plaque by mail. ASME SERAD and the ASCE Infrastructure Resilience Division (IRD) will present the winners for Part A and Part B, respectively, with US$1,000 cash award (to be shared among authors), and subsidize the travel of one author up to US$500.

Part A: active Calls for Special Collections

Special Collection on "Special Collection on Benchmarking Data-driven Site Characterization Methods" (SC052A). Paper submission deadline: August 1, 2022.

Part B: active Calls for Special Issues

Special Issue on "Special Issue on Digital Twins: A New Frontier in Critical Infrastructure Protection and Resilience" (SI053B). Paper submission deadline: December 31, 2022.

Social media (Twitter and LinkedIn)

The ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems in its two parts is now also active on Social Media. Follow our pages on Twitter and LinkedIn:

 Twitter: ASCE-ASME Journal of Risk and Uncertainty

 LinkedIn: ASCE-ASME Journal of Risk and Uncertainty

 https://chinahow.guide/wechat-registration-sign-up/ 

to stay up-to-date on latest issues, highlighted journal content, active calls for special issues and special collections, recognitions and awards.

Calls for Papers

Submission

Part A: Submit to Part A here

Part B: Submit to Part B here

State-of-the-Art Reviews (Part A) and Review Articles (Part B) on topics of current interest in the field of risk and uncertainty are especially welcome.

Please contact the Editor or Managing Editors by email if you are interested in guest editing a Special Collection (Part A) or a Special Issue (Part B).

Incoming Outgoing	Michael Beer, from Leibniz Universität Hannover, beer@irz.uni-hannover.de Bilal M. Ayyub, University of Maryland, ba@umd.edu
Managing Editors	Sankaran Mahadevan, Vanderbilt University, sankaran.mahadevan@vanderbilt.edu Kok-Kwang Phoon, National University of Singapore, kkphoon@nus.edu.sg
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ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems
More Information: https://ascelibrary.org/journal/ajrub7 Contact Prof. Bilal M. Ayyub, Editor in Chief, ba@umd.edu

On the Effect of the Electrical Load on Vibration Energy Harvesting Under Stochastic Resonance

Alevras, P.

ASME J. Risk Uncertainty Part B. March 2021; 7(1): 010902.

2021 Best Paper Award

Abstract

Vibration Energy Harvesting (VEH) is a promising alternative for powering wireless electronics in many practical applications. Ambient vibration energy in the surrounding space of a target application often involves an inescapable randomness in the exciting vibrations, which may lead to deterioration of the expected power gains due to insufficient tuning and limited optimal designs. Stochastic Resonance (SR) is a concept that has recently been considered for exploiting this randomness toward improving power generation from vibrating systems, based on the coexistence of near-harmonic vibrations with broadband noise excitations in a variety of practical mechanical systems. This paper is concerned with the optimal conditions for SR in vibration energy harvesters, exploring the frequently neglected effect of realistic architectures of the electrical circuit on the system dynamics and the achievable power output. A parametric study is conducted using a numerical path integration (PI) method to compute the response probability density functions (PDFs) of vibration energy harvesters, focusing on the effect of standard electrical components; namely, a load resistor, a rectifier, and a capacitor. It is found that the conditions for SR exhibit a nonlinear dependence on the weak harmonic excitation amplitude. Moreover, the modified nonlinear dissipation properties introduced by the rectifier and the capacitor lead to a tradeoff between the power output and the nonconducting dynamics that is essential in order to determine optimal harvesting designs.

A Recent Review of Risk-Based Inspection Development to Support Service Excellence in the Oil and Gas Industry: An Artificial Intelligence Perspective

Aditiyawarman, T., Kaban, A. P. S., and Soedarsono, J. W. (June 7, 2022).

ASME J. Risk Uncertainty Part B. March 2023; 9(1): 010801.

Review article

Abstract

Inspection and Maintenance methods development have a pivotal role in preventing the uncertainty-induced risks in the oil and gas industry. A key aspect of inspection is evaluating the risk of equipment from the scheduled and monitored assessment in the dynamic system. This activity includes assessing the modification factor's probability of failure and calculating the equipment's remaining useful life (RUL). The traditional inspection model constitutes a

partial solution to grouping the vast amount of real-data inspection and observations at equal intervals. This literature review aims to offer a comprehensive review concerning the benefit of machine learning in managing the risk while incorporating time-series forecasting studies and an overview of risk-based inspection methods (e.g., quantitative, semiquantitative, and qualitative). A literature review with a deductive approach is used to discuss the improvement of the clustering Gaussian mixture model to overcome the noncircular shape data that may show in the K-Means models. Machine learning classifiers such as Decision Trees, Logistic Regression, Support Vector Machines, K-nearest neighbors, and Random Forests were selected to provide a platform for risk assessment and give a promising prediction toward the actual condition and the severity level of equipment. This work approaches complementary tools and grows interest in embedded artificial intelligence in Risk Management systems and can be used as the basis of more robust guidance to organize complexity in handling inspection data, but further and future research is required.

Improving Site-Dependent Wind Turbine Performance Prediction Accuracy Using Machine Learning

Barber, S., Hammer, F., and Tica, A.

ASME J. Risk Uncertainty Part B. June 2022; 8(2): 021102.

Most Read Paper

Abstract

Data-driven wind turbine performance predictions, such as power and loads, are important for planning and operation. Current methods do not take site-specific conditions such as turbulence intensity and shear into account, which could result in errors of up to 10%. In this work, four different machine learning models (*k*-nearest neighbors regression, random forest regression, extreme gradient boosting regression and artificial neural networks (ANN)) are trained and tested, first on a simulation dataset and then on a real dataset. It is found that machine learning methods that take site-specific conditions into account can improve prediction accuracy by a factor of two to three, depending on the error indicator chosen. Similar results are observed for multi-output ANNs for simulated in- and out-of-plane rotor blade tip deflection and root loads. Future work focuses on understanding transferability of results between different turbines within a wind farm and between different wind turbine types.

Firearms, probabilities, and protections

Recent events have rightfully brought firearm possession and regulation to the forefront of the political and social spheres. Firearm deaths are generally broken down in two categories, suicide and murder, for example see the Pew Research Center data reduction.[1] A trend in the statistics at the Pew Research data show that the murder rate has increased in recent years even though the overall rate of deaths has slightly decreased on a per capita basis. Out of all murders, firearms represent about 76% and other means are about 26%.[2]

Although most of the leading causes for death are far greater than murder or suicide involving firearms, it makes sense that the moral judgement associated with the decision to use a firearm to murder another certainly puts it in a distinct category that deserves our attention.[3] From the CDC website, the leading causes for death in 2020 were:[4]

Heart disease	696,962	Chronic lower respiratory diseases	152,657
Cancer	602,350	Alzheimer's disease	134,242
COVID-19	350,831	Diabetes	102,188
Accidents (unintentional injuries)	200,955	Influenza and Pneumonia	53,544
Stroke (cerebrovascular diseases)	160,264	Nephritis, nephrotic syndrome and nephrosis	52,547

In 2019, homicide was ranked the 16th highest and as stated above about 76% of those homicides were from firearms.[5]

It seems that the risk for firearm murder could be reduced using technology that would allow for something like a one-time and timed say, for one or two hours, disable mechanism on some firearms. The concept would be similar to that used to disable stolen vehicles. Possibly a more effective method would be to require liability insurance for firearms. Again, the the mechanism could be similar to automobile insurance. The age, sex, mental health, and other relevant factors could be used by actuaries to determine the proper insurance cost. For example, the murder statistics are pretty clear in carving out age range. groups.[6]

Protective systems that disable a firearm may not be allowed under the US Constitution.[7] However, it looks like (a layman's perspective) the Constitutional right would not be infringed if use of the firearm is other than protection of liberty, property, or self-defense. If allowed under proper regulation, a disabling mechanism could be engineered as a protective system. This kind of idea is already being explored and may show promise in the near future.[8]

Loss of life due to homicide is distinct from "natural causes" no matter the mechanism employed.[9] Poisons, knives, blunt force, and other available means of homicide involve minimal design requirements. But firearms are engineered systems that might be designed and managed with protections that would limit consequential outcomes in society. I wonder if now is the time for engineers to get deeply involved in firearm protective systems that would limit their efficacy in homicidal acts?

Let's talk!
Ernie Kee, SERAD Editor

[1] https://www.pewresearch.org/fact-tank/2022/02/03/what-the-data-says-about-gun-deaths-in-the-u-s/. Website accessed 07 July, 20

[2] https://www.criminalattorneycolumbus.com/which-weapons-are-most-commonly-used-for-homicides/. Website accessed 07 July, 2022

[3] See CDC Deaths and mortality Statistics for statistics. Website accessed 07 July, 2022.

[4] https://www.cdc.gov/nchs/fastats/deaths.htm. Website accessed 07 July, 2022

[5] https://www.cdc.gov/nchs/data/nvsr/nvsr70/nvsr70-08-508.pdf. Website accessed 07 July, 2022

[6] https://www.statista.com/statistics/251884/murder-offenders-in-the-us-by-age/. Website accessed 07 July, 2022

[7] In the US Constitution, the Bill of Rights includes the Second Amendment that contemplates a need for citizens to keep and bear arms: "A well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed.".

[8] For example, https://www.denverpost.com/2013/05/22/new-wireless-controller-can-monitor-disable-guns-remotely/ Website accessed 9 July, 2022.

[9] For example, https://cjrc.osu.edu/sites/cjrc.osu.edu/files/AHSV-Distinguishing-Homicides-from-Natural-Deaths.pdf. Website accessed 9 July, 2022.

SERAD Committee

Table 1. 2021–2022 SERAD Committee Membership

Executive Committee		Appointments	
Position	Person	Position	Person
Chair	Xiaobin Le	**Nominating Chair**	Mohammad Pourgol-Mohammad
1st Vice-Chair	Arun Veeramany	**Award Chairs**	Jeremy Gernand John Weichel
2nd Vice-Chair-Treasurer	Stephen.Ekwaro-Osire@ttu.edu	**Newsletter Editor**	Ernie Kee
3rd Vice Chair-Membership	madiacon@ncsu.edu	**Webinars / Outreach Chair**	Open
4th Vice-Chair-Secretary	Andrey Morozov	**Student Program Coordinator**	Deivi Garcia
Past Chair	Mohammad Pourgol-Mohammad	**Technical Content Coordinator**	Giulio Malinverno
IMECE 2022 Track Chair	Bill Munsell	**IMECE 2022 Track Co-Chairs**	Andrey Morozov Mihai Diaconeasa Ernie Kee John Wiechel Alice Sun