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Guest editorial

Reliability analysis is a process aiming to analyze the reliability of a technical system. It provides basic information to asset managers in their planning resources to ensure the system operating at a desired level of performance. Infrastructure systems are an essential asset in modern businesses and its reliable operation is important to the countries as their incapacity will have a debilitating impact on security, national economy, national public health or safety, or any combination of these matters. Thus, ensuring the availability and safety of these infrastructure systems are vital for business operation. As such, research on reliability analysis of infrastructure systems is needed in modern businesses.

To respond to the need for maintenance and reliability modeling research for infrastructure systems, we organized this special issue. It was planned for some papers of high quality from the 2020 Asia Pacific International Symposium on Advanced Reliability and Maintenance Modeling (APARM2020), Vancouver, Canada (August 20 to 23, 2020). The Symposium eventually became an on-line virtual conference due to the COVID-19 pandemic. The special issue was open to any authors who did not attend the conference.

The special issue includes 10 papers covering probability distribution estimation, resilience analysis, risk and safety assessment and analysis, and performance analysis and optimization. Below we briefly introduce the 10 papers.

There are two papers on methodological development. One is by Hua and Gui[1] and the other is by Zhu et al.[2] In the real world, the failure of an item may be due to a number of factors, which are competing to cause the system to fail. In addition, such failure data may be censored. Hua and Gui[1] drew statistical inferences for the Lomax distribution under the assumption that there are multiple competing risks and that the data are progressively Type-II censored. (2) Risk assessment and analysis are normally performed based on a sufficient amount of relevant data. [AQ: 1]. In reality, nevertheless, data may not be sufficient. Expert opinions have to be solicited. Zhu et al.[2] proposes a new risk assessment method, in which they borrowed the techniques of the belief rule base and fault tree analysis.

Energy infrastructure systems play an important role in modern life. There are six energy related papers published in this special issue.

With the global warming becoming a real threat to life on the earth, generating green energy is a solution to mitigate the risk. It is paramount to manage the resilience of the green energy generation systems efficiently. To respond this need, Dui et al.[3] proposes a new method to manage the resilience of the wind power generation system.

As an important infrastructure system, nuclear plants need a low level of risk and ensure very high level of safety and reliability, which implies that every subsystem and component must be carefully attended. With the use of different levels of probabilistic safety analysis, Xu et al.[4] introduce an approach for performing holistic and comprehensive evaluations the risk of a subsystem in a nuclear energy generation system.

Condition-based monitoring techniques are useful tools for gathering data about the health information of engineering systems. With the help of analyzing data collected from sensors that monitor the weak areas in a liquefied natural gas wharf, Zhang et al.[5] develop a method to assess the structural health state of the system.

Wang and Li[6] develop classification methods, which were originally developed by researchers from the machine learning research community, to assess the transient stability of power systems. They found that the AdaBoost-based tree augmented naive Bayesian classifier can significantly improve the classification performance of the transient stability assessment of the power system.

Wang et al.[7] proposes to use the generalized stochastic Petri net model to evaluate the safety of the subsea high integrity pressure protection system (HIPPS). They applied various test methods to detect failures and assess the reliability of the components in a HIPPS under the influence of common cause failures and incomplete repair.

The increasing miniaturization of RF devices and microelectro-mechanical systems (MEMS), as well as the advances in wireless technologies, can provide a promising infrastructure for gathering information about parameters of the physical world. Batteries in a wireless device are not able to provide endless power and the challenge for long-term and self-sustainable operation becomes a research theme. Li et al.[8] proposes a novel two-dimensional continuous-time Markov chain model for analyzing the stability condition of a wireless powered device with a finite energy storage buffer.

The other two papers relate to safety assessment for liquid tanks and reliability improvement for computer memory systems.

Chen et al.[9] propose a novel safety assessment method for the structural safety assessment of large

liquid tanks, where the belief rule base and finite element method are used. The finite element method is borrowed to in the construction of the BRB model, which integrates expert knowledge and industry standards for the case when expert experience is lacking. Different working conditions are also considered.

Dynamically managing the memory storage in a computer can ensure the reliability of the computer. Garbage collection is a useful method in storage management. Feng and Zhao[10] assume that the occurrences of garbage collections follow the nonhomogeneous Poisson process and proposes two discrete garbage collection policies to meet the goal of time consumption for a generational garbage collector.

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